

# Building Professional Capital: Teachers information literacy practices using Twitter

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## Abstract

### Building Professional Capital: Teachers information literacy practices using Twitter

Teachers' professional development has long been a focus of study for educational researchers. Social media provides teachers with new ways of connecting with others in order to discuss their professional practice and development. This is often at the informal end of the professional development opportunities that teachers experience. This study is conducted against a growing background of literature on social media use by teachers. The aim of this study is to investigate how and why teachers use the social media platform Twitter to both discuss their practice of teaching, but also how they develop information literacy practices around their use of the affordances of Twitter. Set in the wider context of practice theory, this study looks at both the learning and practices involved using Twitter as a medium.

Using Nahapiet and Ghoshal's model of social capital to explain how the construction of a network of individuals builds social capital between those individuals, increasing opportunities for exchange and combination of information emerge through teachers' use of Twitter, helping them create new intellectual capital. Using the sociocultural theory of information literacy practice developed by AnneMaree Lloyd, the study explores how the digital affordances of Twitter and other affordances are used to enact information literacy practices across the platform and beyond. The study explores the challenges and opportunities for the development of teacher's professional practice and their reasons for using Twitter.

Four teachers, two based in England, one in Scotland and one in the Northwest United States were recruited. A case study methodology was chosen, with qualitative methods that collected data over time. Social media data was collected along with interview data over a period of 5 months. Content and thematic analysis was undertaken to identify the key themes relating to the research questions.

Participants are enacting information literacy practice. The importance of the profile in making judgements about the construction of the social capital as well as in the judgement of credibility of information is explored. The role of the digital affordances in managing high levels of information flow is seen, in addition to the role played by those affordances in the storage and extraction of the information found is also discussed.

This study explores how and why teachers use the digital affordances available to them to manage the flow of information, store and extract it to build professional capital. The use of Twitter by teachers to increase their social capital when they are in schools with low social capital is identified. This study contributes to what is known about the information literacy practices of teachers, particularly within the context of the use of digital affordances available in social media such as Twitter.

## Declaration

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For  
Mum and Dad  
I did it!

and Dominic  
with love

## 1. INTRODUCTION

Teachers are increasingly using the social media platform, Twitter, to connect with other teachers, share resources and ideas as well as engage in debate and discussion around the practice of teaching. Twitter is an online 'stream' of short messages or 'Tweets' that individuals can put out into the public domain that can be read or shared (retweeted) by others. Photographs, links to other sites or documents, conversations and interactions all provide ways to create content that others can engage in. Individuals 'follow' other people, so their 'timeline' is a continuous stream of tweets from the people who they are following. Individuals have chosen to follow those people because their 'profile' – a description about themselves - or the content of their tweets has interested them. Tweets can also contain hashtags (eg #ASEchat) that are searchable terms allowing individuals to follow topics, connecting people who may not follow each other. This process then creates a network of individuals who can interact with each other and their Tweets containing information, narratives, and discussions. (A full glossary of Twitter terminology is provided in Appendix A).

These activities and uses of language, structured around information sharing and consumption, create a practice. A practice is 'a nexus of doings and sayings [that are] spatially dispersed and temporally unfolding (Schatzki, 1996:89). Teachers engage in the practice of teaching in classrooms each day. They also engage in practices around Twitter when they navigate and make use of this constant stream of information and knowledge, as they need to develop the ability to find, access and judge the validity and veracity of the information they find. This information is not just text-based, but consists of the narratives, the discussions about practice and the embedded experiences of others. This combination of both finding information and making judgements about it and sharing and communicating it is the practice of information literacy.

Information literacy is defined by Lloyd (2014) as 'a practice that connects us with information and knowledge about other practices that shape our setting and context' (page 99). Information literacy is a set of activities, knowledge and skills enacted when people engage with written texts, with others in discussions and

when draw on their own experience to solve problems over time. Teachers on Twitter are enacting information literacy as they use Twitter to connect with others, find information and talk about their practice. The application has become a substantive part of their *information landscape* as described by Lloyd (2012): this landscape 'reflect[s] the modalities of information (agreed upon sources) that people draw upon in the performance of their practices in working or everyday life'. For example, the landscape of teaching would include sources such as the exam specification, the experience they have had with a class, or the observation of another teacher in action.

Twitter has many affordances to enable individuals to draw upon an information landscape. An affordance is defined as the actual and perceived properties of something that determine how it could possibly be used (Salomon, 1993, page 51). For example, a knife can be used to cut food, however, it can also be used to butter bread. Twitter affordances include the ability to add photographs, direct messaging, and profiles, that are available to the user to carry out an action or activity. Spink, Foster, Sadler and Given (2007) outline two different types of affordance; the object's intended use (the real affordance) and the affordance perceived by the user (perceived affordance). Returning to the example of the knife, the real affordance would be to cut food, but I have the perceived affordance – a tool to remove hot cross buns from a toaster. The affordances are defined by the person using it and their current need.

Hargreaves and Fullan (2012) introduced the idea of professional capital, as comprised of three key aspects – human, social and decisional capital. Human capital is the talent and ability of the individual. Social capital is the resources embedded in relationships between people and can include the knowledge and information held in the network. The quality and quantity of those interactions and relationships affects individuals' access to knowledge and information. Decisional capital enables them to make wise judgements in situations where there is no fixed rule or evidence to guide them. Professional capital lies within the teacher and this is different to professional development which is the activities undertaken to improve a teacher's practice. Professional development can be undertaken and not



improve the professional capital of a teacher, equally, professional capital can be increased without undertaking professional development..

Each of these factors is key for the choice of type and organisation of professional development of teachers- not only recruiting high quality entrants, but developing their decisional capital as they become more experienced in order to allow them to make correct judgments in the moment and understanding how relations with others in the profession can support and sustain their development – creating a profession with high professional capital to operate within the education system.

The concept of social capital is well established in research and has been widely used across different disciplines including education and business (Putnam, 2000, Naphiet and Ghoshal, 1998 Tsai and Ghoshal, 1998). There is field of research into the professional development of teachers and particularly their informal learning (Kyndt et al 2016, Hoekstra et al 2009, Eraut 2000, 2004, 2007, 2010, 2011 Evans 2014, 2019). There is a growing field of research into the professional development of teachers using Twitter. For example, Carpenter and Krutka (2014, 2015), Rosell-Aguilar (2018) and Nochumson (2020). The study of information literacy in professional development is well established particularly through the work of Annemaree Lloyd (2010, 2011, 2012, 2014, 2017) and those who have studied the intersection between teachers' professional development and information literacy practices (Kyndt et al 2016, Cogan and Martzoukou 2018).

This research pulls together the fields of information literacy practice and social capital to understand the role of Twitter in teachers' professional development. If engaging via Twitter is impacting on a teacher's social capital by increasing the number and diversity of an individual's relationships, how are they subsequently finding, accessing, and evaluating the extended information landscape that they have now constructed? Having gained the skills to draw on that information landscape – how does this impact upon the professional capital of the teachers involved? That is the focus of this research.

## 1.1 Aims and Research Questions

When I posed the basic question – why teachers use Twitter as their professional development activity – the hypothesis was that they would increase their own professional capital through developing increased social capital. Appreciating how individuals enact information literacy on Twitter is vital in understanding how this happens.

In this research I address the following questions:

- 1. How do individuals build social capital to facilitate information literacy using Twitter?** This question focuses on the affordances of Twitter to build a network, increasing the social capital of the individuals. I focus on aspects such as the users' profile, the choice of who to interact with and how to present their 'online presence' in the network. How do the individuals use these affordances to identify and access the information and knowledge base in the profession? How does the building of the network shape the individual's engagement with the landscape and access to information?
- 2. How do teachers use the affordances of Twitter to increase their professional capital?** Having built the network to increase social capital this question explores how the affordances of Twitter are used to manage the information made available. How do they enact information literacy in the information landscape to identify, store and extract information and subsequently communicate this to others? What activities make up this literacy practice via Twitter? Is this a key aspect of their information literacy practice that impacts upon their professional practice?
- 3. Why do teachers choose this platform to build their professional capital?** This final question focuses on what the affordances of Twitter bring to the individuals' information literacy practice to improve their professional practice, particularly how they have increased their professional capital. While teachers

may not be aware of the term information literacy practice, they may be enact some aspects of it, through their use of this platform, although this is not always the case. What motivates individuals to engage in information literacy to connect them to the practice of teaching?

I use a case study methodology involving four teachers who are using Twitter to connect with other teachers. I examine their experiences of using Twitter, including asking them to reflect on their own Tweets and interactions.

I use a range of qualitative methods including the use of repeated interviews over 5 months with participants reflecting on their Twitter interactions and capturing the participant's tweets and their responses to others. Using the data, I explore the affordances of Twitter that enable individuals to enact information literacy, connecting them to the practices in this setting. I present this as an analysis in chronological order, from the participants joining the platform, through their experiences and use of Twitter and its affordances. Using two key theoretical perspectives – professional capital and information literacy - I identify how the affordances of Twitter facilitate the building of social capital, allow brokerage across boundaries of practice and impact on the professionalism of everyone, thereby increasing their professional capital. While much research in this area focuses upon the gain individuals report, this research looks at how the individuals develop their own information literacy practice using those tools to gain at a network and individual level.

## 1.2 Rationale

In this section, I place the research in the wider field of professional development as well as providing a narrative on aspects of my own professional experience that are relevant to this study. I also identify why there is a need for a focus on teachers' use of Twitter in understanding their reports of the benefits of this tool for their professional development.

### 1.2.1 Informal learning

Eraut (2004) describes the formal – informal professional learning as a continuum and this clarifies where this research project sits in the professional learning continuum. At one end are the formal opportunities such as attending training courses, in the middle are activities such as mentoring and at the far end is the implicit and unstructured learning in the absence of a teacher or trainer.

Most of the professional development research focuses upon organised, formal professional development including training courses and workshops. Both Eraut (2004) and Evans (2019) argue that the ‘implicit end of professional learning or the development continuum, in contrast, is greatly neglected and under researched’. Eraut (2004) points out that this is because it is problematic to research as it is often invisible, unrecognised, and taken for granted, and the knowledge generated is often tacit. Evans (2019) states that to move the field of professional learning forward we need to place these informal processes as a higher priority and adjusting our methodological approach away from interviews and questionnaires and towards more ethnographic approaches.

The concept of Communities of Practice (Wenger, 1998) is often used in research into informal learning. Wenger Trayner (2013) defines a community of practice as:

*‘a group of people who share a concern or passion for something they do and learn how to do it better as they interact regularly’. (para 5)*

A community is the development of shared identity that ‘represents a collective intention... to steward a domain of knowledge and to sustain learning about it’ (ibid). Whatever it is they do, in order to learn how to do it better, individuals must have access to the information, narratives and shared understandings of the community. This requires them to engage in information literacy practice.

Lloyd (2014) describes the practice of information literacy as central to formal and informal learning and so it is important to view it in the context it happens and in all its forms. However, she also points out that the complex workplace means individuals draw from a range of information across the landscape, which is complex, messy and distributed across connections, so it is more difficult to access

and research. However, just because it is difficult should not mean we do not investigate it. It is important to understand how information literacy happens to contribute to our understanding of informal learning.

### 1.2.2 My experience as a teacher on Twitter

At the start of the Doctorate in Education, I was not a teacher who was on Twitter. I joined around the Spring of 2012 and rapidly became involved in a core network of individuals who were using it to share ideas, resources and opinions. The ability of individuals to connect with other teachers outside of their current school was not new, but this different environment was allowing rapid sharing of new ideas and pedagogy. This rapid accessing of knowledge and dissemination of knowledge intrigued me as a teacher and researcher, how did teachers access this and develop their practice of teaching without the formal structures and learning delivered to them.

I undertook a literature review into the informal learning of teachers, particularly in reference to the movement of knowledge between individuals (Golton 2012) prior to my joining Twitter. This provided evidence of the different frameworks such as communities of practice (Wenger 1998) and the work of Professor Michael Eraut (2000, 2004, 2007, 2011) on professional competence which are used to explain the informal learning of professionals. In 2014 I carried out a pilot study

(Golton 2016) to trial methods including interview techniques and the analysis of Twitter data. Both research papers allowed me to both understand the conceptual frameworks on informal learning but also to identify the gaps in our current knowledge of teachers' use of Twitter for professional development such as why and how they use the affordances of Twitter.

The pilot study involved interviewing a teacher about her use of Twitter, and the reasoning behind it. This was something that had not yet been undertaken in the previous two research papers. The pilot study indicated that Twitter is just one source of information that an individual draws upon in learning how to do their job better. Other sources included family, and colleagues in face to face interactions.

An important finding was that some social relationships operate both in face to face interactions as well as Twitter. This enables sustained interactions across geographical distances and indicated that Twitter is not operating in isolation from the rest of the information landscape. The interviews revealed that there are reasons for an individuals' use of Twitter, they are making decisions and judgements, choosing what they share and what they take, and what they do with the information provided. Behind each activity there is a reason for that action, individuals enfold Twitter into their information landscape, it is not separate from it. The concept of information literacy was not considered in the pilot study; however, it became increasingly evident that this study was based in this field as I asked questions about how individuals navigated the information landscape that they had created by using Twitter and how did increasing social capital impact upon their information literacy and professional capital.

## 1.3 Contribution to Knowledge

In order to understand the impact of Twitter on an individuals professional capital and how this particular professional development activity impacts upon it, this study focuses on both why and how an individual uses this particular platform to build their own social capital, but then how they share narratives, artefacts and information. Once shared, how each individual teacher extracts and stores that information and the decisions that this involves is important in understanding how these impacts upon an individual's practice. While there is a large body of research into information literacy practices, there is no research that focuses on how these practices are building professional capital in teachers. This research looks at both the information literacy practices on Twitter in specific group, but also how these practices build social, decision and human capital increasing the individual's professional capital.

### 1.3.1 Twitter and its functions explained

This section will outline the key terminology and affordances of Twitter that are discussed in this thesis.

**Twitter** is an online micro-blogging platform. This allows users to put short messages of initially up to 280 characters (originally only up to 140 characters) onto a publicly accessible platform that other users can see. These messages can include text, videos, links, and images and are called **tweets**.

Figure 1-1: My own Profile



The **profile** is the photograph, images, and description that an individual attaches to their account. This indicates location and date of joining Twitter, as well as numbers of followers and following.

Not all individuals are as forthcoming. Names may be real or pseudonyms. The accounts may be linked to geographical areas or schools, or users just highlight their educational interests.

Figure 1-2: Example of Twitter Profile with few details



These profiles can be edited at any time and all aspects can be changed including the Twitter handle. Individuals can add, remove or provide false information on a profile.

The platform operates on a **followers / following** structure. A person may follow you so they subscribe to your tweets that will appear in their **'timeline'** – the stream of tweets they see. You can also follow them (following) so their tweets appear in your timeline. This does not mean that everyone will necessarily follow and be followed by the same people, for example, many well-known people will have a small number of people they follow, but an exceptionally large number of followers.

A **Twitter handle** is in the form of @NAME and will often appear in tweets as a **mention** or a **reply** to that user. Including a Twitter handle in a tweet is often called **'tagging'**. The Twitter handle is one of the first things that an individual chooses when setting up an account. The username is just above the handle.

**Lists** are a way of grouping individuals you follow so that you can then see those tweets in a new timeline, without others in. This allows individuals to create timelines that are personalised to their interests. For example, I have a list related to the American football team Arizona Cardinals containing the organisation's Twitter account, those of players, reporters and other people in the British Bird



Gang supporters' group so I can view a list of those related tweets without any educational tweets.

**Direct messaging** is the ability to send a message to another user privately, that cannot be seen by others. Often this is referred to as DM in a tweet.

You can **reply** to another's tweet and this will then create a 'chain of tweets' that show a 'conversation' between users. These chains of replies are called **threads**.

A **hashtag** such as #BeRedSeeRed can be added to tweets to allow them to become searchable or used to coordinate across activities such as conferences or sporting events. This is done via Twitter's own search tool or via other software such as Tweetdeck. However, the use of hashtags means that users can search for the hashtag and see what happened in the conversation after the event, making the information available for weeks afterwards. This means that hashtag chats are both synchronous and asynchronous so individuals are not limited to participation during that specific time. Including the hashtag in other tweets at different times means that those involved in the chat can connect outside of the organised chat or share information that is useful to those who were involved.

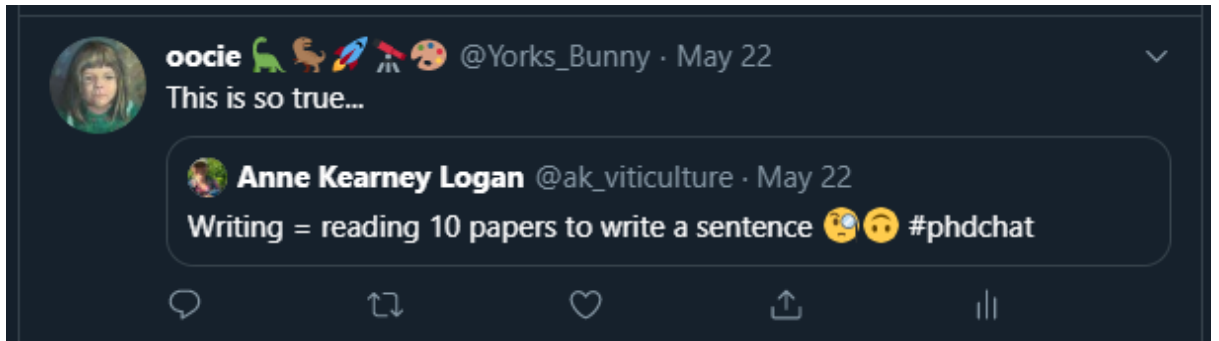
The **like** button could be selected on a particular tweet if the viewer felt they wanted to indicate their view on the tweet for the original writer of it – they 'liked' their tweet in a similar way to Facebook. This can be seen by both the person who tweeted it and individuals who look at their profile- if it is public- as well as the person liking it. 'Liking' adds it to a list in a user's profile so they can go back and look at those selected Tweets, as can anyone who views that profile.

**Bookmarking** is a recently introduced affordance. The difference with bookmarking rather than liking tweets is that bookmarks are private and cannot be seen by other users. There is no endorsement element in using the bookmark tool compared to the 'like' tool. It is simply for the person bookmarking who can then access a list of bookmarked tweets.

**Retweeting** is often represented by the letters RT. This is when a user tweets another user's tweet on their timeline. This can be with or without an additional

comment. The two arrows are the retweet button. For example, see below where I retweeted another person and commented.

Figure 1-3: Example of Retweeting with comment



A tweet can contain many of these elements in just a single tweet as seen below.

Figure 1-4: Example of Tweet with likes, retweets, replies, link to Tower of London and hashtags



The tweet above has been 'liked' by 187 people, retweeted 41 times and has 6 replies to it. There is a mention to the Tower of London as well as three hashtags.

**Pinned tweets** are fixed to the top of a user's timeline, so it is the first thing that a person would see underneath the person's profile. These can be changed only by the user.

**Notifications** are indicators when you have been mentioned in a tweet, or a tweet has been retweeted, replied to or liked by another.

**Muting** is a way of removing a key term, hashtag or person from your timeline and notifications. You are still able to see the tweets if you choose but you do not see the tweet in your timeline.

**Blocking** is a way of preventing a user from seeing any of your tweets. It also prevents them from direct messaging to you, retweeting your content or tweeting and including you as a mention in it.

While blocking is clearly seen when individuals try to follow the person who has blocked them; muting is not visible. Only the person doing the muting knows that they have muted someone and it cannot be checked by others

## 2 LITERATURE REVIEW

I will first outline the wider field of practice theory that this research fits into. I will then outline the research into information literacy and professional capital, with a focus on social capital. Finally, I outline the current research into the use of Twitter by teachers and educators.

### 2.1 Practice Theory

#### 2.1.1 Understanding “Practice”

To understand what the term practice means I look to the work of Theodore Schatzki (1996) who defines practice as ‘a nexus of doings and sayings [that are] spatially dispersed and temporally unfolding’ (Schatzki 1996 page 89).

If the sayings and doings are dispersed over an area – for example, a school, and they happen over time - it is important to look at them across these areas such as the organisation or context and see how they develop and evolve over time.

Schatzki further expands on this to explain how these practices are organised:

*‘Practices are constituted as open-ended, spatio-temporal manifolds of actions that are organised in three ways. First, an understanding of how to do things (practical understanding), e.g. explaining, questioning and describing. Second, rules, i.e. the formulations that prescribe, require or instruct. Third, teleoaffective features which structure emotions that are acceptable or prescribed for participants in practice’. (page 249).*

Teleoaffective structures are not only focused on the ‘in the moment’ emotions, but the goals, moral purposes and identity judgements. While practice does involve rules, individuals are expecting some element of payoff, such as self-satisfaction, a sense of achievement, or enhanced status. For teachers, teleoaffective structures are powerful influences on their practice – the drive to be a better teacher, for the students to do better and the enhanced status, promotion and personal satisfaction that comes from this.

Important to this study is the continuum of practices – from dispersed practices to integrated practices. Dispersed practices are ones such as questioning and explaining that occur across multiple domains and sections of social life. In contrast, integrated practices are more complex practical domains of social life such as teaching. To integrate the practices into settings requires a practice architecture, one that includes ‘equipment’ that roots practice in places and times. For example, without the objects such as exercise books or registers, the practice of teaching can still be defined by most people, but it requires those pieces of equipment to embody the practice and integrate it into a setting, so individuals can learn the practice of teaching (Schatzki 1996). In this study, the equipment that individuals are using are the tools of Twitter in order to integrate information searching into their context.

Embedded in all the definitions of practice is the importance of utterances or sayings – what people say matters – it is the individual’s expression of one aspect of their practice, with a distinct set of characteristics for the practice they are engaged in. These ‘sayings’ are also organised around Schatzki’s three-way model. The practice of teaching would be organised round the practical knowledge to ‘teach students’ such as classroom organisation, how to plan a lesson, manage behaviour; The second aspect – the rules of practice would include, the expectations of a teacher such as how to run the classroom, interacting with parents or staff and safeguarding procedures. The final aspect is what is teleoaffective features that are prescribed: for example, in teaching, anger is not an emotion that is readily expressed in most situations; however, the maintenance of a calm emotion is.

The final definition of practice is Kemmis (2009) who also provides a distinct description of professional practice:

*[E]ach distinctive kind of practice presupposes traditions of practice in which there are characteristic arrangements of words, utterances and ideas in distinctive discourses, characteristic arrangements of activities in distinctive kinds of work, characteristic arrangements of things and objects, and characteristic arrangements of social relationships between people and groups’. (page 24)*

We cannot separate practice from social relationships, from our activities or our utterances. So, in order to understand practice, we must observe relationships and the dialogue that individuals engage in around their practice and in the context it happens. Looking closely at the arrangement of activities such as assessment, the arrangement of objects such as tests or exercise books and the relationships between individuals such as senior leaders and classroom teachers. From the outside – teaching may appear to the non-teacher as a homogeneous activity, particularly as everyone goes to school so has an experience of this. However, by teachers researching teacher professional practice, there is a higher chance of identifying the distinctive characteristics of say, Science teaching, compared to English teaching as well as the characteristics that apply to both.

A final concept is that of genres (Whitworth 2014) – ways of conceptualising reality, ways of seeing and interpreting aspects of the world. These genres govern our speech. In the context of this research study, the tweet is a genre:

*‘a particular text type is to recognise a particular communitive situation and activity in which that type of text (genre) is used to accomplish a given task’* (Anderson 2008 page 349, Cited in Whitworth 2014).

Importantly, Anderson (2008, Cited in Whitworth 2014) states:

*‘the more we know about the communicative activities in which we are involved, the more we know how to understand and use the texts produced by these activities’* (ibid, page 349).

In summary, practice involves social interactions, objects, history over time, dialogues, emotions, and constraints around it. It is a complex field involving individuals, groups and the environment into which this study is set.

### 2.1.2 Practice and Learning

Schatzki (2017) provides a good example of how practice is linked to learning:

*‘learning.... Consists first, in attaining greater facility and possible excellence in the performance of sayings, doings, tasks and projects that compose a practice’* (page 31)

*‘second, when they become able to perform more of the actions that make up their practices’ (page 32)*

and finally,

*‘third, when people better choose what to do in a practice. This can involve reasoning better or making choices that are better informed by the state of the world’ (page 32).*

Learning is doing the ‘practice’ better, being able to carry out more activities of the practice, and improved decision making around the practice. This is an important aspect which is developed further in this research.

In this study I am interested in how practitioners strive to develop their professional practice and learning and negotiate with others what competency looks like in the practice of teaching. Twitter affords them the ability to communicate with other teachers about their practice of teaching and around which information literacy practices also develop. I now turn to the idea of informal learning, information literacy and how information is turned into knowledge in order to further develop the theoretical background to the study.

## 2.2 Information Literacy

### 2.2.1 Introducing Information Literacy

There is a longstanding and wide-ranging body of research literature that has focused on the professional development of teachers and its impact on teacher quality and student outcomes.

Within the current research into professional development, the focus ranges from looking at formal professional development opportunities to the informal and sometimes tacit learning undertaken in the workplace. (see Golton 2012 for full literature review of this area).

Evans (2019) and Eraut (2004) both use Reber’s (1989) definition of implicit learning, that is:

*'the acquisition of knowledge independently of conscious attempts to learn and in the absence of explicit knowledge about what was learned'.*

However, Evans (2019) adds to this as:

*'the learner.... is unaware of at the time of its occurrence, but of which s/he may (or may not) subsequently become aware' (page 12).*

It is this informal and sometimes implicit learning, that is under researched according to Evans (2019), that this study has focused upon.

A key aspect to learning to be a practitioner of a workplace practice involves information literacy. Lloyd (2012) describes information literacy as

*'a collective practice, one which not only connects people to rational and instrumental aspects of their performance but also to the embodied and affective aspects that shape identity and situate people within that social context. We become information literate and operationalise information literacy in ways that reflect a negotiated understanding of what constitutes knowledge and ways of knowing' (page 775)*

According to Lloyd (2010) information literacy is a dispersed practice that produces shared understandings about the knowledge and information that is sanctioned by a community. As a dispersed practice, it is found across many integrated practices including teaching, learning and the workplace. Lloyd (2012) argues that if we are to look at information literacy as a practice, we have to look at it in the social site in which it is set and identify the activities that make up the practice. These contexts or sites will contain practice architecture and affordances that shape the information literacy practice that happens within it and may be unique to the site and the community. Even if we look at two groups of individuals engaged in the same integrated practice such as teaching, their information literacy practices may be quite different depending on the affordances and structures within each person's context. We cannot separate the information literacy practices and how they are enacted from the site in which they are happening over time.

Lloyd (2017, page 93) states that information literacy practice is enacted by:



- *Drawing on modalities of information that reference the knowledge base*
- *Recognise ways of knowing that are valued by members of the setting*
- *Engage in activities that form part of the individual and collective performances and*
- *Use the material objects and artefacts that are sanctioned as part of the performance.*

The enactment of the information literacy practice requires engagement in different modes of information, being able to access information that is in social relationships, and not only recognising the information that is valued but able to use it in their teaching or work performance. Initially, I will explore the different modalities of information that individuals draw on.

The information a person will engage with exists in different modalities: epistemic, social and corporeal (Lloyd 2010, pp. 161-5). Epistemic modality includes the codified rules and regulations of an organisation. It is often text based and universal. Teachers will often engage with epistemic knowledge in the form of exam specifications, government documents and school policies. An individual's learning in this modality is often measured against written criteria, such as the teacher standards that are the codified rules of teaching practice. A novice will often engage with this modality first, for example, in handbooks, recommended reading, help pages or government guidance. Easily codified, these sources help novices to understand what it means to be a practitioner in a community as they begin their journey from novice to expert.

The second modality is the corporeal modality where knowledge is shared through demonstration or observation of practice. Of importance for teachers in their performance is the corporeal modality as they learn to navigate and orientate themselves in the classroom. This is a common way of sharing knowledge within teaching, through observations of teachers and is used throughout a teacher's career but particularly at the start when they are learning the practice of teaching. Having observed the individual, an experienced practitioner can identify the gap in knowledge about the practice and then remedy this. This modality of information is

often tacit and only accessed when going through the physical practice using the body in the place of work. It cannot easily be articulated to others.

The final modality is of interest; the social modality produces the 'know how' or tacit knowledge that is embedded in ongoing relationships with people who are in engaged in the same practice. As the information is tacit it is often difficult to articulate by written text and is nuanced. It can also be the norms or conventions of a practice that are unwritten. By engaging with others, individuals gain both subjective and intersubjective understandings of practices such as teaching and assessment. This information is often accessed through the narratives or storytelling element but is shaped by the history and culture of the community, drawing in novices to the practice of the group. For individuals to access information in this modality they need to build relationships with others, they need to build their social capital.

These information modalities reflect the stable, established knowledge domain of the social site and together form the information landscape. Individuals who are involved in the landscape can then draw others in by sharing information gained from it and narratives about it. In the performance of teaching, teachers draw on all three modalities of information in different amounts. By engaging with this information in the pursuit of better performance, individuals develop better understanding of what important knowledge is as well as making links between the modalities.

To engage with the information and knowledge available the social site needs to have a range of affordances that allow individuals to engage with different information activities. Textual affordances allow individuals to engage with the codified knowledge – the epistemic modality; social affordances provide opportunities to collaborate with others and negotiate a shared understanding of the information and practice – the social modality. The physical affordances allow individuals to engage with the symbols, tools and physical environment – the corporeal modality. For an individual to take up these opportunities, they must perceive the opportunity and value provided or they will not engage with the information provided through that affordance. Equally those affordances are not

equally distributed or accessible. For example, a novice or newcomer in a workplace may not have access to the social affordances of good relationships with others and must instead rely on the textual affordances of workplace policies and handbooks. An experienced teacher may have access to textual affordances but choose to reject them in favour of information in the social modality provided by social affordances that provide opportunities to share narratives, develop shared meanings and perhaps conflict with the institutional view.

For both a novice teacher and an experienced one, the physical affordances are context dependent, decided not by them, but by the layout and organisation of their classroom and school. While they may have some control over where they stand, or the type of planner they purchase, the physical affordances are predominately prescribed by the institution or social site.

Having discussed the modalities of information and how they are accessed via affordances, I now turn to the activities that make up information literacy practices.

Lloyd (2010) describes how information literacy is enacted – that is the activities that are undertaken in information literacy practice. She highlights four key activities – influence work, information work, information sharing and entwining.

Influence work is important to engage new members of the community with information about the history, traditions, practice and performance of the community. It allows newcomers to map the information landscape including those sanctioned sites of knowledge and develop shared understanding. Through this, the community shapes how information is shared, what information is valued and how it is understood by the members. Activities such as storytelling or narratives allow individuals to create shared meaning and understanding of the practice. This would happen when a teacher joins a school or is training to teach when they will be presented with the codified knowledge in the forms of recommended reading or staff handbooks and policies.

Information work is designed to direct the new members of the community to the collective knowledge in different modalities; for example, being observed by an expert teacher in order to identify the gaps in knowledge or documentation. This

allows the production and reproduction of the collective knowledge of the community. This occurs as new teachers engage in their training in the school placement, or as they engage in teaching and meetings within a new school department where discussion about both codified and social information is shared.

Information sharing is an activity rather than a practice that enables individuals to give and receive information and is influenced by the saying and doings of the community. This dialogic relationship will directly affect the information and influence work that occurs as it can draw practitioners together through activities such as storytelling. (Lloyd, 2010).

Entwining or coupling is the awareness of the where information is situated and how to access it within different modalities. This brings together explicit, tacit and relational knowledge to produce ways of knowing. This process is vital to allow the novice to become an expert as they bring together all the information across their information landscape to bear on their practice. As individuals become further embedded in the community, they not only expand their information landscape, but are able to locate the information and how to access it. For teachers, this is often the unwritten norms and values of the school as well as knowing who to ask for information and how to navigate their classroom.

It is the activities of information work, influence work, information sharing and entwining that form the sociocultural activities of information literacy. Their enactment is influenced by the social site in which this occurs, for example, what modalities of information are available, what material objects are embedded and how the site is configured. So, in order to understand information literacy, we must explore the practice within that context as different contexts will have differences in the availability of information, configuration and objects available.

There is much empirical research into information literacy activities however, this is dominated by the skills-based view of information literacy in the information and library sciences domains, with little in relation to teachers and their information literacy practice.

Using the idea information literacy is sociocultural practice, Lloyd (2011) has looked at the information literacy practices of renal nurses during the performance of their work and ambulance officers (Lloyd, 2008) both in their training and then in on road practice. Other contexts have been explored using this approach including information practices around apprentice chefs (Fafeita and Lloyd, 2012), medical call centres (O’Farrill, 2010) and even car restorers (Lloyd and Olsson, 2019). For this specific research, a key research project undertaken by Cogan and Martzoukou (2018) looked at the information practices and continuing professional development of teachers. They found that the language and terminology of information literacy was not well understood, and that the context was of real importance to the development of information literacy for teachers. This study links information literacy, CPD and learning together ‘as they intersected within a single, organic situated learning practice of becoming an expert in context’ (page 600). Of interest, in this research, is that all the participants were placed at the same site – a Jewish school, they were able to interact daily and shared the same performance context. Teachers who are interacting on Twitter will not necessarily share the same performance context and those contexts may not share the same understandings of knowledge, or what counts as knowledge. This raises the question of how individuals manage that difference in their practice.

Geeraerts et al (2018) studied the information seeking interactions in a secondary school. As well as identifying the content of such activities including subject matter knowledge, classroom management, innovative teaching methods and ICT, they found participants sought information from different people depending on the subject matter they required and the age of the person. Older teachers are less likely to ask for advice and information about the subject matter, classroom management, and innovative teaching methods, but they are more likely to be asked for advice about the subject matter but not innovative teaching or ICT. The age of teachers did not matter when asking or giving advice about ICT. This is an interesting study as it introduces another dynamic into the information seeking interaction – that of age of the person. Given that Twitter is a social media platform, the expected engagement would be with the younger teachers, however,

this may not be as straightforward as supposed. The information seeking and giving role in relation to age may also be played out on Twitter depending on the uptake of the platform by older teachers.

Olsson and Lloyd (2016) focused on embodied information practices. These are important sites of knowledge as they are:

- *Always situated*
- *Expressed corporeally, and central to actors understanding the social and epistemic modalities of the landscape*
- *Act as a site for know-how knowledge, which cannot be effectively expressed in written form*
- *Local/nuanced, drawing from expertise in situ and may be contingent and only available at the 'moment of practice'.*

(Olsson and Lloyd, 2016)

For teachers, the corporeal information and the role of embodied information practices are key as they learn to teach, placing them within the classroom and responding to their own sensory information including sight and sound as they undertake teaching practice or observe a more experienced teacher at work. From my own experience, the ability to identify students chewing gum from the smallest behavioural clues from them in a classroom is an aspect of embodied information practice that astounds my colleagues who cannot do this. Observation is a fundamental aspect of teacher training where students at the start of their journey will observe experienced teachers first before being allowed to participate in the practice that may have been modelled to them. How, then, does this play out on Twitter, where teachers cannot necessarily observe each other? Or do they choose not to provide access to this modality of information?

### 2.2.2 The information available in the digital world

Digital literacy is one aspect of information literacy and is defined by Rantala (2010) as being able to participate in social practices that involve meaning making with digital technologies and media. So digital literacy is tied up with the information literacy practices of those involved in online communication. In order to explore

information literacy practices involving social media and the internet, it is important to place it in context, with an understanding of the volume of information that individuals are exposed to and the challenges that this can create.

At present we live in a world where we have an 'overabundance of information'. This is defined by (Zurkowski 1974 cited in Whitworth 2014) as the availability of information exceeding our capacity to handle it. For individuals to move from 'data'/ information to knowledge, they must do cognitive work to understand the information and then integrate into their knowledge. This cognition requires individuals to give meaning to information. It is not just embedded into the individual but needs a dialogic interaction that allows those involved to make meaning from the messages or utterances (Whitworth 2014). As Linell (2009) states knowledge is:

*'dependent on communication between individuals for its genesis, evolution, and maintenance, and for its disappearance; knowledge wilts away if it is never communicatively sustained across generations'* (ibid, page 214).

This study is situated in a field where knowledge is linked to dialogue between individuals in order to make sense of world. As technology increases our access to information, and access to others to engage in a dialogue with, this intersubjectivity is important in the distribution of knowledge (Whitworth 2014). This links back to the idea of utterances and activities – to move information to knowledge we must engage in it, have dialogue around it and use it. These sayings and doings around the information shape our understanding and so our practice.

Individuals draw upon their own perspectives in order to make judgements in the information landscape that the community has created (Whitworth 2014). Harris (2008) states that all communities offer opportunities to learn; these communities of practice are where:

*'information is created, disseminated and utilised by members to support the goals of the group. Collaboration and experiential development are necessary activities... and specific or unique uses of language may develop between members.'* (page 248).

Artefacts are a vital part of both practice theory and information literacy. These artefacts allow dialogue to take place and develop the meaning of the information (mean making) for the individuals involved. Reckwitz (2017, page 115) points out that the 'organisation of interrelated artefacts, interpreted by both participants and observers' is a social process. The tweets produced by individuals are artefacts, while other aspects of Twitter allow the artefacts to be organised. They are 'constituent parts of information landscapes, but they are produced in different ways from the community, with its basis in dialogue' (Whitworth 2014). Artefacts are produced by cognition and collaboration, embedding not only practical knowledge but ways of thinking such as the scientific method. The rising importance of artefacts is put forward by Burkitt (1999 page 41 cited in Whitworth 2014) as artefacts 'replaced the gene as the mode of transmission and change within societies'. Our collective knowledge and understanding is being transmitted by artefacts and our interactions and dialogues around them as we engage in the practice.

Observing how information literacy happens in a context allows us to investigate 'the information exchanges, genres and artefacts' (Whitworth 2014). This then allows us to identify what knowledge, activities and information are acceptable in a setting or genre such as teaching or on social media.

### 2.2.3 Challenges in knowledge formation and practice

The transfer of information into useful knowledge is not a forgone conclusion. As novices enter the landscape, they must become literate in the practice of the landscape – learning the sayings and doings of the practice (Lloyd 2010). New teachers must become literate in genres such as assessment, pedagogy and professional expectations, identify and apply the contextual rules and practices and engage in the community's information landscape. This landscape is not just unique to the individual but also conditioned by the community through dialogue including those around different community artefacts (Lloyd 2010) such as exam papers, specifications, and the all-important 'scheme of work'.

Communities can be highly effective and trusting or dysfunctional and exclusionary, even preventing knowledge formation. Lloyd (2010) states that communities can



constrain the sharing of information and create barriers between groups. By the very nature of the modalities as social and corporeal information, they can exclude people from the community or even prevent them from moving into a novice role.

Prior to development of Twitter or social media, Shenk (1997) wrote of the overload of information creating what he called 'data smog' – the information that is crammed into our world, not just physical but electronically through the affordances of technology. In the many 'Laws of Data Smog' Shenk (1997) stated that 'Birds of a feather flock virtually together' (page 123). While people were gaining access to more information, they would tune to specialised information and knowledge that they were interested in. By 2012, Pariser (2012) described how algorithms developed by companies such as Google and Facebook were harvesting the data you produce to provide a personalised internet experience. If I googled cat products, then my Facebook feed would start being filled with targeted ads for products relating to cats. Individuals have become a source of data that is converted by organisations to generate money. As the internet monitors what you have done, searched, liked, it will extrapolate and refine to

*'create a unique universe of information for each of use... a filter bubble – which fundamentally alters the way we encounter ideas and information'*  
(page 9)

This is Pariser's (2012) 'filter bubble'; you are in it alone, creating a different experience for you than for anyone else. The filter bubble is invisible, you have not chosen those filters and so you assume that the information that comes through is objective, true and unbiased; but the filter bubble makes it difficult to see how biased it is. Finally, you do not choose to be in the filter bubble as you have not decided about what filter you want to use, but the filter has been imposed on you.

So, any individual engaging in the internet is doing so in a personalised filter bubble. That bubble means that we all see different information and Pariser (2012) states that there are less opportunities for chance encounters through which learning, and insight can happen, however, he also raises an issue about social capital. Putnam (2000) described two types of social capital. Bridging capital, where individuals from

different backgrounds would come together to solve problems and bonding capital which is 'in group' with those of similar interests and understandings. Pariser (2012) found that the social capital generated within filter bubbles is more bonding capital, rather than bridging, as filters direct you to people who hold what the algorithm judges are the same interests or views as you. The filter bubble removes the dissenting, different information that we could otherwise encounter and simply paints the world as we want to see it. Or as Heurer (cited in Pariser, 2012) stated 'we tend to believe that the world is as it appears to be'.

If individuals in social media are seeing their information through the filter bubble lens, with strong bonding social capital for shared interests then this risks the creation of groupthink in any group including communities of practice.

Jeanes (2019) defines groupthink as:

*'A type of group decision-making dysfunction that occurs when members of the group seek consensus at the expense of critically evaluating their decisions. .... groupthink captures how group members suppress dissenting voices within the group to maintain consensus (or the appearance of consensus) and separate the group from influences outside the group which may challenge their decision. Groupthink leads to .....the 'illusion of invulnerability', which overstates the group's capacity to make good decisions and leads them to discount alternative viewpoints. As well as leading to poor decisions, groupthink also demonstrates potential dysfunctions with highly cohesive groups, as individual critical judgement is discouraged or penalized'.*

This manipulation of the information that individuals encounter on the internet is a key constraint on access to information across the information landscape. You are engaging with those that agree with you, see the same information that supports your view, reducing the opportunities for an individual to hear different, conflicting information that might expose bias. The filter bubble creates the echo chamber in which groupthink thrives while strangling out the voices of dissent or difference.

Groupthink was also raised by Wenger et al (2009) who states, 'online gatherings of large groups of people who are interested in the same subject can create an illusion that the group is 'the whole world' '.

A final challenge is the large number of relationships that individuals have can mean they become overwhelmed with the number of interactions and it becomes important that they are more selective (Wenger et al 2009). Yet, Whitworth (2014) points out that because we live in multiple communities, there is a polyphony of voices and that 'it is through dialogue that experience variation in the voices we encounter, learn from and engage with' (page 128). We now have the ability to engage with the everyday experiences of people across the world, and Twitter, provides a way of filtering and sorting the huge amount of information once individuals learn how to control it. Individuals are developing practices in order to do this. While the filter bubble may be applied to our digital information, we need to acknowledge that media and authorities have always filtered what we see and read in an attempt to influence our connections and thinking. Therefore, the nature of social media can both provide diversity and/or narrow the slice of information and practice individuals encounter. The filter bubble can make it more difficult to find that diversity but if an individual wants those diverse connections, the technology can facilitate that.

#### 2.2.4 Summary

In summary, learning is a complex process, involving information literacy practices, discourse, the affordances of the practices and the context in which the learning happens. The increased knowledge, supported by artefacts and affordances of tools leads to learning – increased excellence in the practices, being able to perform more complex activities, or engage in more complex discussions and better decision making.

This research study is situated in this practice theory field, acknowledging the complexity of practice, its context and both the dialogue that individuals engage in and the resulting differences in their 'sayings' and 'doings' of their practice. The second concept used in this research is the ideas of professional capital and particularly social capital that are explored in the next section.

## 2.3 Professional and Social Capital

The concept of human and social capital is widely used by researchers. Hargreaves and Fullan (2012) use the concept of professional capital and investing in it to develop high quality teachers in ways relevant to the study of informal professional learning.

### 2.3.1 Professional Capital

According to Hargreaves and Fullan (2012), professional capital consists of three key parts – human capital, social capital and decisional capital.

Hargreaves and Fullan (2012) define human capital in teaching as:

*'having and developing the requisite knowledge and skills. It is about knowing your subject and knowing how to teach it, knowing children and understanding how they learn, understand the diverse cultural and family circumstances that your students come from, being familiar with and about to sift and sort the science of successful and innovate practice.. having the emotional capabilities to emphasize... possessing passion and the moral commitment... to want to keep getting better in how to you provide that service' (page 89)*

This definition shows the complex nature of a teacher's professional competence. Not only is there the required subject knowledge, but also pedagogical content knowledge (see Shulman 1986) and the emotional skills combined with a commitment to getting better and better at the practice. This also links back to the way Schatzki (2017) describes processes of learning; the increased ability to perform the 'sayings, doings, tasks and projects that compose a practice' as well as the more flexible use of materials and arrangements. Teachers need to reflect on action to support this (Schon 1991) and identify Schatzki's (1996) practical knowledge that can be applied in their context to improve their performance. Much of this will come from the intertwining of different modalities of information in the course of their practice.

Decisional capital is defined by Hargreaves and Fullan (2012) as:

*‘the capital that professionals acquire and accumulate through structured and unstructured experience, practice and reflection – capital that enables them to make wise judgements in circumstances where there is no fixed rule or piece of incontrovertible evidence to guide them’. (page 94)*

This can be further developed by drawing on other colleagues’ experiences and insights to be able to form judgements. Again, this requires reflection on action and has the teleoaffective structures of practice to be embedded. This links to the third of Schatzki’s learning of practices – ‘people better choose what to do, ... reasoning better or making choices that are better informed. Without this aspect of learning individuals will not increase their decisional capital. The social and corporeal modality of information predominates here as individuals both listen to narratives and advice as well as absorb and reflect on the embodied knowledge from the corporeal modality. It takes time to develop and is increased when individuals seek out opportunities for feedback and working with others to develop their practice – they engage with the practice of the community.

The final piece is social capital, which Hargreaves and Fullan (2012) define as:

*‘how the quantity and quality of interactions and social relationships among people affects their access to knowledge and information; their senses of expectation, obligation, and trust; and how far they are likely to adhere to the same norms or codes of behaviour’. (page 90)*

Social capital is a key aspect of this research and I will discuss in more detail.

### 2.3.2 Introducing Social Capital

It is social capital that allows individuals to access the human and decisional capital of others. Asking questions of colleagues about both subject knowledge and pedagogical content knowledge is an example of accessing others’ human capital. Asking what to do with a difficult student, or in dealing with a colleague, would fall into the realm of decisional capital. Access to either is limited if the social capital of the individual is limited. Limited social capital means limited access to social and corporeal modalities of information, to artefacts around which dialogue can

happen, and limited engagement in the sayings, doings and teleoaffective structures of the community.

An important question that remains is whether social capital impacts upon student attainment. Hargreaves and Fullan (2012) refer to Leana and Pil (2006) who looked at the human and social capital of teachers and their students' maths scores at the beginning and end of the study. Those students who had teachers with higher social capital had better results, even if the teacher had a lower human capital. This is an unexpected finding given the mixed results of research in standard professional development and its lack of sustained impact on students. This is again an area that needs further research to uncover that informal learning that takes place when teachers have high social capital and how better to facilitate this.

Nahapiet and Ghoshal (1998) focus on the building of intellectual capital, defined as:

*'the knowledge and knowing capability of a social collectivity such as an organisation, intellectual community or professional practice'* (page 245).

If we take the idea of the new intellectual capital as new 'sayings and doings' of a particular practice then this brings it together with social capital. Individuals who have built social capital to gain access to others to negotiate new meanings and new ways of doing things in the practice in which they engage. The dialogues around artefacts between experts and novices in the practices of the community should lead to learning so social capital facilitates access to the practice of a community.

Nahapiet and Ghosal (1998) define social capital as:

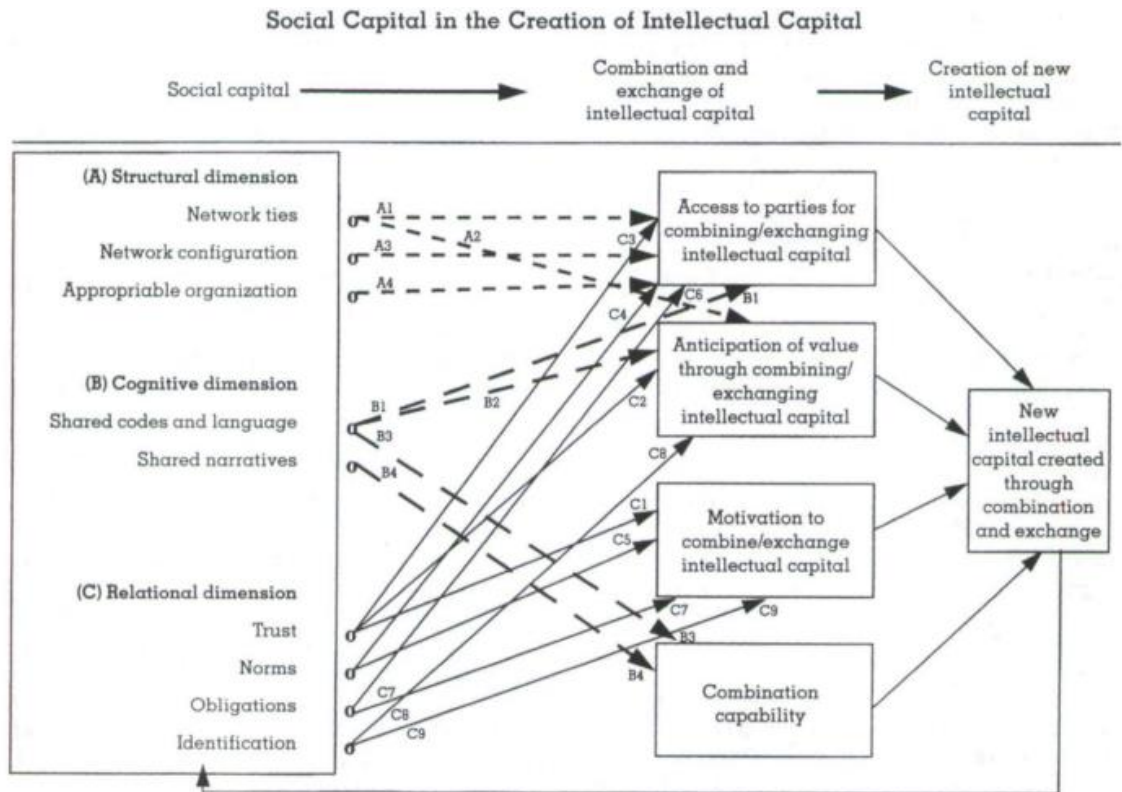
*'the actual and potential resources embedded in, available through and derived from the network of relationships among possessed by an individual or social unit'* (page 243).

There are two forms of social capital – bridging and bonding social capital. According to Putnam (2000) bonding social capital is the network created that is dense, homogeneous, and trustworthy. While bridging social capital brings together

different groups to gain access to resources not available inside the trusted network created by bonding social capital.

In Nahapiet and Ghosal's paper, they use the model seen below to explain how social capital can be used to build intellectual capital.

Figure 2-1: Social Capital in the Creation of Intellectual Capital (Nahapiet and Ghosal 1998)



They argue for three dimensions of social capital – structural, cognitive and relational. These allow the combination and exchange of intellectual capital and lead to the creation of new intellectual capital for the group or organisation. Of interest is the importance of access, anticipation of value and motivation for the exchange and combining required to build intellectual capital and these are important in understanding how and why teachers are using Twitter for professional development.

Schatzki (2017) explains what improved practice entails, and Hargreaves and Fullan (2012) are clear that social capital matters for improving practice. Nahapiet and

Ghoshal's model unpicks the many factors that allow social capital to facilitate the changes in individuals practice.

### 2.3.3 Structural Dimension

In the structural dimension within Nahapiet and Ghoshal's model, they include both network configuration and appropriate organisation, as well as network ties, to allow access to others for building intellectual capital. While this can be considered as just a technical issue, it also shows how the affordances of informational tools offer both opportunities and constraints for the associated social site that shape the information literacy practices that happen within it. Not just the material configuration of Twitter affordances but how the community and its members configure other affordances, such as email and how individuals organise their network and find and build 'ties' related to the affordances across the platforms that they have chosen to use.

Nahapiet and Ghoshal (1998) describe the central proposition of social capital – 'network ties provide access to resources' and in their case – the resources are information. They cite Coleman (1988) who states that relationships established for other reasons can be used as information channels to reduce the time and resources needed to gather the information. Bert (1992 cited in Nahapiet and Ghoshal 1998) gives three benefits – access, timing and referrals. Access is receiving knowledge and knowing who can use it providing a screening and distribution element for people. This then influences access to parties and anticipation of value. Timing is being able to access the information more quickly than those without such social contacts. Finally, referrals are about providing information about opportunities that are available to individuals in the network, influencing the opportunities to exchange information and may involve the reputation of the individuals involved. Therefore, network ties are the cables through which knowledge flows – most often epistemic and social knowledge rather than corporeal.

A network configuration and organisation can support the development of social capital, or can limit it depending on its structure, size and configuration. These will again constrain or allow different information literacy practices in that network site



at that time. The individuals who has an information rich network configuration has established links to the places where the important information is likely to be seen and who will provide a reliable flow of it. These configurations can influence the range of information accessible and available for combining.

Nahapiet and Ghoshal (1998) state 'not all dimensions of social capital are reinforcing'. It needs bearing in mind that the configuration of a network may not necessarily be optimal for the community's learning. Returning to the idea of groupthink and the 'filter bubble' (Pariser 2012), the nature of social media algorithms means the structural dimension can be structured presenting individuals with 'similar' ideas and people as they access the network through the filter bubble. This narrows diversity rather than widening it, increasing bonding capital but restricting bridging capital. This can restrict access to other practice as well as facilitate it.

The network structure such as the density and connectivity of individuals, as well as the network ties, influence group members' access to new knowledge. Too dense and/or large and it becomes more time consuming to access the knowledge of others compared to a smaller, less dense network. Loose ties, or bridging capital can allow a diversity of knowledge to be accessed (Granovetter, 1973), but just because individuals can, this does not mean they will actively include such diverse voices in their information landscape. Nahapiet and Ghoshal (1998) acknowledge this aspect that can constrain the development of intellectual capital. They also cite Hansen (1996) who found that weak ties facilitate searching but restrict the transfer of knowledge, particularly when it is not codified. So, while a larger network may be more time consuming to navigate, it may have a richer source of interactions and artefacts, albeit ones where members must negotiate differences in prior knowledge and meaning as they explore the information landscape. Those larger networks provide more opportunities to interact and develop new ideas using diverse voices helping people to cross the boundary of the community of practice. These individuals carry out information work and influence work to access different modalities of information within and between communities. This is particularly relevant for uncoded knowledge such as teaching practices that teachers are

developing as this information is in the corporeal modality which is difficult to explain to those outside the community.

The final aspect of the structural dimension is the appropriate organisation and how the social capital may be formed in one setting and transferred into another. For example, the development of professional ties due to working together, which then transfer into personal relationships and how this affects the social exchanges (Nahapiet and Ghoshal 1998). Nahapiet and Ghoshal (1998) also identify research where organisational structures and routine can in fact, limit the access to people, limit their motivation and capabilities constraining individuals rather than enabling them (Dougherty 1996 and Hedberg 1981 cited in Nahapiet and Ghoshal 1998). This leaves us with the question how do teachers build these structural elements on Twitter?

#### 2.3.4 Cognitive Dimension

Nahapiet and Ghoshal (1998) believe that intellectual capital is a social artefact that is embedded in the social context and sustained by interactions. They state that this requires some sharing of a context for exchange and that this is done through shared codes and language and shared collective narratives. The shared language facilitates access to others' knowledge, while lack of this sharing can also restrict access. So, access to the social and even corporeal modalities require social capital to develop intellectual capital.

Individuals who do not share the language of teaching are restricted from engaging with the community of teachers. In addition, shared language and codes influence individual's perception allowing them to filter the activities that interested them and evaluate the benefits of exchanging (Nahapiet and Ghoshal 1998). However, being able to use that language allows individuals to access other communities and facilitate multi-membership of communities and increases combination capability. The affordances of Twitter may allow others to develop that shared language and code across different communities allowing them to access other sites of practice and modalities of information.

Individuals tell stories and use metaphors to build shared narratives. This facilitates the exchange of both practice and tacit knowledge and experience embedded in the social modality and allows them to create new interpretations of it. Linking back to the work of Hargreaves and Fullan (2012), it is these shared stories that make tacit knowledge available and support others in developing decisional capital. For example, sharing stories of interactions with difficult students can provide knowledge about behaviour management strategies.

### 2.3.5 Relational Dimension

The relational dimension includes the norms, obligations, trust, and expectations involved in building and maintaining social capital. Nahapiet and Ghoshal (1998) take Misztal's definition of trust as 'the results of intended action will be appropriate from our point of view' (page 254). The individuals mutually recognise the competency and capability of the other parties and this can increase the anticipation of value in the exchange. If there is trust between individuals, then they will be more willing to cooperate and exchange information.

The norms of the group will influence access, motivation, and exchange processes. Nahapiet and Ghoshal (1998) use Coleman's definition of norms - 'a norm exists when the socially defined right to control an action is helped not by an actor but by others' (page 255). Norms in interactions can affect the access to other for exchange of new information. The norm of sharing documents that have been shown in a photograph facilitates the movement of artefacts. However, if the norms are strong and rigid then it can lead to 'groupthink', which does not value diversity and openness, and this would lead to a reduction in the development of intellectual capital as new ideas are not welcomed. The question remains about the norms that are operating within the community of practice of teachers on Twitter around their information literacy practice and teaching practice? In addition is there any evidence of groupthink where there is high social capital but little development of learning?

The obligations and expectations are the commitment to do something in the future – similar to a credit slip (Nahapiet and Ghoshal 1998). These can influence access and motivation to exchange. Individuals who will often build those

obligations and expectations to access the exchange of information – how are obligations and expectations built on Twitter and how are they enacted between individuals? What happens when these obligations are not met?

The final aspect is that of identification as one of the group and how collective concern can increase the chances of exchange and lead to more frequent cooperation. The identification may come from their membership of the group or through individuals taking their values from the group (Merton 1968 cited in Nahapiet and Ghoshal 1998). Yet this can lead to barriers to sharing information, learning and knowledge. If identification is one of the aspects that defines the boundary of a community of practice, individuals who work across boundaries both understand the values of the group but cross the boundary to find and access information in other communities.

### 2.3.6 Exchange and Combination

The three dimensions of social capital identified by Nahapiet and Ghoshal (1998) – structural, cognitive and relational – are important in the combination and exchange of intellectual capital and this section looks at how they work together. The structural dimension links clearly to access to parties for this process, this is supported by trust, norms and obligations. The network configuration and the affordances used will help to access the knowledge that is distributed amongst community members.

The cognitive dimension with its shared language and narratives provides both the anticipation of value of the exchange and the combination capability according to Nahapiet and Ghoshal (1998). This is supported by the relational dimension of trust, norms and obligations of the group. This presents the question – what is the expectation of value when building the online community via Twitter, especially at the start? Why do teachers develop this form of information literacy practice?

Motivation to exchange comes from the relational dimension, however noticeably absent from Nahapiet and Ghoshal's (1998) model is a link from the cognitive dimension to motivation. The motivation to combine may be driven by an increasing need to understand shared narratives and language to move from being

at the periphery of a community to the core member. Individuals may be motivated to develop their network ties – usually better performance of a practice.

The final block in the exchange and combination of intellectual capital is the concept of combination capability – the ability of people to take information and experiences and combine them with their existing knowledge. While Nahapiet and Ghoshal (1998) talk about this in the context of organisational learning, they cite Cohen and Levinthal (1990) who suggest that the ‘absorptive capacity does not reside in any single individuals but depends .... On the links across a mosaic of individual capabilities’ (page 250).

On an individual level, this relates to the human capital of the individuals involved and their prior knowledge but then links to the collective community and the relationships between them. If individuals cannot take the new knowledge or make sense of their experience, then they cannot combine it with their existing practice and act in new ways. Yet, the combination of all the individuals in a community and perhaps across an information landscape provides the collective knowledge required for this combining. Technology and its use may allow individuals to access more intellectual capital, but without the combination capability - the ability to integrate it into their current knowledge - learning does not happen. Individuals are crossing the boundary of communities and their ability to assimilate and move practice from one community to the other is based on their combination capability of different modalities of information.

The concept of combination capability also links to the final element of professional capital – decisional capital. Teachers at the start of their careers will have limited decisional capital; only by engaging in their experiences, talking with others, and reflecting on practice (Schon 1991) will their decisional capital increase. This can only happen if they can exercise their combination capability in addition to having access, motivation and by anticipating value of the exchanges with others. They need to combine their experiences and their colleagues’ explanations and reflections to develop that decisional capital (Hargreaves and Fullan 2012).

Decisional capital is rooted in the tacit knowledge of individuals – often the social and corporeal modalities, how do individuals use the affordances of the technology

to make informed judgements of what appears in their information flow? The practices that they develop both in their use of affordances and in their teaching will have embedded tacit knowledge.

### 2.3.7 Summary

In summary, social capital facilitates the development of both human capital and decisional capital of teachers but with the caveat that they not only have motivation and access to others, but that they also see the value in those exchanges and finally that they have the ability to integrate new knowledge and understanding into their existing knowledge. Social capital allows access to others social information modality but also increases the chance of entwining – combining all modes of knowledge together in the performance of practice.

This research is focused on applying these ideas to teachers who are using virtual networks and social media affordances to develop different forms of capital in the information landscape in which they practice. Individuals are building networks full of social capital that leads to accessing a wide range of information and together with an understanding of the activities involved in information literacy practices in this context, we can see how teachers build, access and use the information stored in those social relations.

## 2.4 Empirical research

So far, I have focused on the two core concepts -- information literacy as a sociocultural practice, and professional and social capital -- that are underpinned by practice theory. However, there is a rapidly expanding body of research that is emerging in relation to information literacy practices, the use of social media in education, and specifically by teachers. This section outlines the key empirical research that has been published in this field.

There is a large body of research into teacher's professional development opportunities both formal and informal. Information literacy practices that I examine are at the informal end of the continuum of formal to informal learning

described by Eraut (2000, 2004). Evans (2019) discusses the importance of this aspect of learning as under researched and yet vital for individuals who are engaged in a community of practice such as teaching. Research has been done into those informal opportunities for example, Kyndt et al (2016) looked at the range of informal learning activities in new teachers in a systematic review. These included collaborations, sharing, learning by doing, reflection and consulting information sources which can all be described as information literacy activities. The research focus has moved to include the use of social media as a method of informal professional development in recent years, and it is the area that I am focusing upon.

The emerging literature on the use of social media has had a wide-ranging focus, from mining big data sets and discourse analysis, to its effectiveness for student learning and organisational learning. (For a literature review of the impact of social media on a wide range of *non-pedagogic* academic practice see Manca and Whitworth 2018.)

Social media and information literacy are expanding fields of research, with studies relating to several different platforms and contexts. This section will outline several key empirical studies in the information literacy field that are relevant to this study.

#### 2.4.1 Information literacy and social media

In the field of information literacy, several researchers have explored the information practices of a range of groups and contexts including social media, for example Mansour and Francke (2017) explored the information practice of a group of mothers using Facebook. Hanell (2016) researched trainee teachers using digital platforms such as Facebook and Google Drive and the information activities that emerge. Of interest is the identification of how institutions think tools should be used and how the students appropriated those for their own ends, indicating that the perceived affordances of the digital tools are different for different users, allowing some to subvert the institutional view of 'correct' practice (here see also Benson, Lawler and Whitworth 2008). Hanell (2016) also highlights that the affordances of social media allow flexibility for participants, but also constrain

participation and discussion quality. There is a trade-off between using the digital affordances and the constraints they also impose.

Zappavigna (2012) looks at discourse on twitter and how technical affordances of Twitter such as hashtags, retweeting and images are used. Of interest is Zappavigna's (2012) understanding of Twitter as individuals 'perform our online identities in order to connect with others' indicating the importance of the online identity presented to others. One affordance used is hashtags for creating searchable talk that amplifies the ability to connect with others and so be able to bond with others. Another aspect is the use of a 'meme' defined by Richard Dawkins as a unit of cultural transmission allowing ideas to be transmitted (for a full discussion of the term see [RichardDawkins.net](http://RichardDawkins.net)). It is not defined as a small image or animated GIF that is an utterance where we are supposed to get the joke. Zappavigna (2012) describes their use for 'social bonding rather than sharing information' (page 101) often sharing an in-joke that can become more widely understood. The meme has a broader aspect than just Twitter as it can be applied to emails and other social media. While the hashtags are part of the affordances provided by Twitter to navigate the information landscape and create bonding capital between individuals.

Research has also looked at the judgements of individuals about the credibility of answers provided over social media (Mansour and Francke, 2017). Yup Lee (2018) looked at the relational characteristics of people who answer questions and how this linked to their credibility. Yup Lee (2018) found that the number of 'friends' on Facebook led to a higher influence on the trustworthiness rather than accuracy of the answers provided. However, Westerman et al (2014) cautions against this direct correlation indicating that some users can see a larger follower group as someone simply 'collecting' followers, rather than having deeper relationships. This is an important aspect involved in the creation of new intellectual capital that is not seen in Nahapiet and Ghoshal (1998) model of social capital. If combining information to create new knowledge is undertaken, individuals will make judgements about the new information to decide whether it is credible, and they should combine it into



their existing knowledge or reject it and there may be other relational factors that influence that including the number of individuals in the social network.

Hajibayova (2019) studied students personal information management practices, which she defined as 'the practice and study of activities that people perform to acquire, organise, maintain, retrieve, use and control the distribution of information items'. While the terminology used is different it does link closely to the idea of information literacy practice. Hajibayova's (2019) study is important as it discusses the way individuals organise their information both physical and digital. Several participants mention bookmarking online resources to find them later and the ability to search to find digital resources when required. Hajibayova (2019) describes how participants can sometimes prefer to 're-find' information by searching rather than storing it. This is also another study that highlights the digital affordances of social network sites that allow collaboration between individuals. Hajibayova (2019) found that they relied on their social groups and the 'crowd' or the public formed from their involvement in social media in determining the credibility of the information they get. Factors that influence this include access to reviews, the developed trust over time between the individuals and institutional organisations such as schools and previous positive experiences. When we look at the social capital model, access, trust and structural organisation is included, however, the ability to judge and evaluate information before combining is not included leading to a possible revision of the model.

The final empirical study that is relevant to this research is about images used in social network communication. Yoon and Chung (2016) looked at the use of images in Tweets in relation to a terrorist attack. They collected and categorised twitter messages containing images into four main types:

1. to illustrate news, information and anecdotes
2. to disseminate visual information that cannot be provided through words
3. to express emotions/ opinions or to call for action from the public
4. to add visual components to emphasise text messages.

They also found that many tweets had text and images that were equally important in communications while others had text to direct readers to the image, and for some, the visual was a supplementary aspect. The information shared in Tweets is not just text based, but visual and so it should be considered in their information literacy practice via the affordances of Twitter.

#### 2.4.2 Educational use of social media

There is an increasing volume of research emerging on the use of social media sites such as Twitter by teachers both as a tool for their students and for their own professional development. Malik et al (2019) provides a review of the literature on the use of Twitter across educational settings. Most studies in this field are from the USA (number of studies=60), with the UK second (number of studies=9). Higher education is the most common context as was the use of students as participants in the studies. Students are readily available, the cost and effort is minimal in using them as participants as outlined by Saracevic (2007). These studies often focus on the use of social media as a teaching tool (see for example, Hull and Dodd, 2017, Welch and Bonnan-White, 2012, Kassens, 2014). Hitchcock and Young (2016) examined the use of Twitter in social work education while Booth (2015) studied nursing students tweets and found a range of elements in their tweets. Some of these elements such as events and situations perceived to be positive or exciting, stress or annoyance messaging and information seeking requests like those observed in the pilot study and previous research papers (Golton, 2012, 2016). Booth (2015) discusses the reasoning for these different types including sharing and seeking information, a trigger or event that occurs to set off a stress/annoyance tweet and seeking support from the group after actual or perceived failure. He also highlights the blurring of professional and personal lives and derogatory and vulgar tweets and the implications upon a person's professional standing. While Booth (2015) acknowledges the lack of context inherent in the research of just the Twitter messages, he regarded some tweets he came across as unacceptable in any context. However there a growing body of literature that looks at the use of Twitter by for professional development and networking.

Another interesting element of current research is the use of social media such as Twitter as a 'backchannel' at conferences and events. A backchannel is defined by Ross et al (2011) as an 'secret, irregular or unofficial means of communication' (page 216). This implies that there are two channels of communication operating at the same time, one is formal and the other informal. Both Greenhow et al (2019) and Kimmons and Veletsainos (2016) look at the differences in this method of communication for large academic conferences. Greenhow et al (2019) found that they were used more to disseminate information than to have dialogues with others and that there was a blurring of the formal and informal activities. However, there was a high level of retweeting that they consider may be helping novices in the community to not only network but 'signal their affiliations, develop commitments and presence in the community as a whole'. Activities such as seeding connections to increase participation over time in a community creating an increased sense of belonging for the newcomer, but for the experts it was perceived as an opportunity to promote their work, so using Twitter as backchannel will operate differently depending on expertise.

#### 2.4.3 Teachers and Social Media

Narrowing our focus to teachers use of Twitter there is also a growing literature base as outlined by Malik et al (2019) and Macia and Garcia (2016). While most study participants are students, teachers are also participating in research into Twitter although in a smaller number of studies. Researchers (Carpenter and Krupka 2014, 2015, Trust, Carpenter and Krupka 2016, Wesley 2013, Cho and Rangel 2017, Davis 2015, Rehm and Notten 2016, Mills 2014, Visser et al 2014, Fox and Bird 2017, Smith and Risser 2013) have all studied the use of Twitter by teachers for professional development. The focus of the research has varied from looking at the use of hashtags by teachers for their professional learning (Greenhalgh and Koehler, 2017, Greenhalgh et al 2020) to analysis of how school leaders use Twitter (Sauers and Richardson 2015) with aspects such as cross country comparisons of Twitter use by trainee teachers (Carpenter, Tur and Marin 2016) and the development of computer systems to identify patterns in usage (Houser et al 2017) included in this field. Many studies see Twitter as an

opportunity for 'grassroots professional development (Visser et al 2014, Carpenter and Krutka 2014, 2015 Davis 2015), as such the predominate focus of current research is how this set of affordances are being used to develop teaching practices

Two studies highlight the state of current research into teachers use of Twitter for professional development. A recent study by Nochumson (2020) looked at the use of Twitter by elementary teachers in the USA. Using Twitter as a recruitment tool, the methodology consisted of an online survey, combined with analysis of the tweets and interviews with some of those who had completed the survey. The results showed that teachers engaged with Twitter and learned how to integrate technology techniques, finding, and using information to alter their practices and identifying educational opportunities. However, Nochumson (2020) found that much of the information in a tweet is superficial information, with anecdotal solutions. This then requires a much deeper level of processing with others to link the information with the practice. Referring to the information work outlined by Lloyd (2010) the individuals concerned need to entwine the information together with the other information modalities they are experiencing to put it into practice. Nochumson (2020) also raises the issue of the accuracy and legitimacy of online information as in the USA. She highlights key data from the study that shows that some participants are learning to make judgements about the credibility and accuracy of information including looking at the person who is posting the information on Twitter. The final important aspect of Nochumson (2020) discusses is the possibility of the echo chamber, highlighted by both Pariser (2012) and Cho and Bryant (2016). She finds that the participants involved engaged with those who challenge their thinking and matches the findings of Carpenter and Krutka (2015) who also found individuals connected with a diversity of perspectives. However, it is still important that teachers can critically evaluate such information as it is produced by others. Finally, Nochumson (2020) points to the need for further research outside of the USA to understand if this is applicable globally.

This echoes much of the research carried out before. Davis (2015) found that Twitter provided a way to 'reflect upon practice, exchange knowledge and experience, and be in the presence of supportive colleagues'. The ability to connect

with diverse individuals and perspectives, combined with the instant and concise communications are positives reported. However, this study also highlighted the volume of information and that teachers had to develop skills to manage this flow, yet there is no real discussion of how they do this other than using third party software to do so. In other words, their information literacy is only being considered at a basic, technical level. Filtering is discussed by Davis (2015) with the use of a hashtag to enable searching, and the use of hyperlinks. Again, this study highlights the judgements needed by the individuals in deciding what to take and discard, but no discussion of the affordances of Twitter and information literacy practices that support this.

Most research, however, focuses upon the teacher development and learning experiences that happen by using social media, but do not discuss how the individuals involved are using, and learning to use, the affordances of Twitter to manage this flow of information. Certainly, the term information literacy is not mentioned in the research papers reviewed in relation to teachers' professional development in this area.

These affordances and their use of them is dependent on what the individual's information literacy practices that is shaped by the affordances and the network they have created. However, there is limited discussion about what the Twitter affordances allow individuals to do regarding information literacy. For example, while Forte et al (2012) look at the groups of teachers who congregate round a hashtag (a search term), they do not explore what the use of a hashtag does for the individual teachers; why do teachers, and the group, perceive this particular hashtag to be important? There is much discussion about the use of Twitter to 'microblog' for example, Goodyear et al (2014) or Carpenter and Krutka (2014) but how does this integrate with other digital affordances of the information landscape such as blogs, links and images?

New technology has provided new ways of both collecting and analysing data related to social networks and social media. The methodology is predominately participant self-reporting including methodologies such as surveys (Carpenter and Krutka 2014), open ended questions (Carpenter and Krutka 2015), written

reflections (Carpenter, Tur and Marin 2016), collecting Tweets round a particular hashtags and conducting social network analysis or other data analysis methodologies on the data collected (Rehm and Notten 2016, Greenhalgh and Koehler 2016, Gil Ramirez and Guilleumas Garcia, 2017), literature reviews (Malik et al 2019, Nagle 2018) and interviews, participant observation and collecting online documents (Wesely 2013). These provide a variety of different ways to look at the data that can be harvested from Twitter and its uses both qualitatively and quantitatively, from the very focused analytics using computers and social network analysis to the more in depth participant observations all provide different, but important data to the field. While participant observation and tweet collection over time is used in the current field, there is no use of repeated interviews with participants, only singular ones with the researcher. Thus, they take only a single 'snapshot' of practice instead of seeing how practices develop over time, and how teachers learn to use Twitter as a tool for managing their information flows. This combined with the evidence of recall difficulties in the pilot study were drivers of my subsequent methodological approach discussed in Chapter 3.

The literature review undertaken by Nagle (2018) reviews the issues of Twitter, cyber violence, and teacher education. Individuals have a range of ways to mitigate their experiences – some avoid the abusive content, others will 'out' the content by retweeting for public shaming while gaining support from others. Ignoring 'trolls' whose aim is to instigate a conflict is often avoided by simply ignoring them. This review raises an important point about the methodology surrounding research into Twitter and education. The majority of participants in these studies are white and that a large proportion of abuse is directed to women, particularly black women, those of indigenous heritage, people of colour and those from the LGBTQ communities. Therefore, when looking at the positive aspects of Twitter, sample bias may have resulted in the under reporting of abuse and cyber violence experienced by teachers. Nagle (2018) is clear that the lack of diversity poses a problem when considering research into the use of Twitter.

#### 2.4.4 Social Capital and Social Media

Williams (2019) conducted a systematic review of the literature regarding the use of social network sites and bonding social capital. This paper distinguishes between nurturing and cultivating of bonding social capital. Nurturing is maintaining the existing capital and cultivating is the process of acquiring and developing bonding social capital. Their literature search revealed four studies looking at education and information sharing using the concept of social capital. However, other findings are relevant to this research. For example, one paper found that bonding social capital was not associated with Twitter, but the perception of it through the number of followers was found in another (Hofer and Aubert 2013, cited in Williams 2019). Studies showed that social network sites did not always work to maintain offline relationships (Brandtzaeg et al 2014 and Brandtzaeg 2014 cited in Williams 2019) but that those offline relationships are maintained through other means. Instead, social networks were more likely to create bridging social capital/weak ties than reinforce existing bonding relationships.

The other study relevant to this research into Twitter, teachers and social capital is the 2016 paper by Rehm and Notten (2016). This paper focuses on analysing a conversation around a hashtag and then carrying out social network analysis. The researchers harvested data from Twitter accounts of individuals who were involved in an education chat round a particular hashtag for a year. The data included number of tweets posted, numbers of followers and following and how long they had been on Twitter. They then applied social network analysis of this data focusing on only the structural dimension of social capital formation in Nahapiet and Ghoshal's (1998) model. Their findings support previous research that shows that the concept of social capital can be used to explain the benefits that teachers can have from networking and in understanding professional development. Rehm and Notten (2016) found that the personal networks increase over time to allow individuals to gain increasing access to resources and knowledge. Some teachers gain and sustain a more central position in networks and, while able to access more sources of information, may let these individuals dominate and steer conversations in particular directions. Rehm and Notten (2016) states that this finding support

other research around dominant individuals and groups and how they can control communication and limit others opportunity to gain social capital. They also acknowledge the limitations of their study – the lack of analysis of the content of the conversations (cognitive dimension of social capital) and the reasons for engaging in the Twitter conversation (relational dimension of social capital). Rehm and Notten (2016) point out that future research should ‘investigate whether and how teachers are generally searching for useful information on social media’. Both researchers also point to the need for more research to provide a ‘more complete picture of the practical relevance of the theoretical model of social capital... ideally also investigate these currently lacking dimensions and determine possible interaction effects between the three dimensions’ (page 222).

In summary, there is a growing field of evidence and analysis of the use of social media, with social capital, teachers’ professional development and information literacy. However, there is not a study which looks at the role of social capital and information literacy practices around Twitter for teachers. This research seeks to fill the gap in research about teacher’s information literacy practices while using Twitter for professional development.

## 2.5 Summary

This leads to my three key research questions below:

- 1. How do individuals build social capital to facilitate information literacy using Twitter?** This question focuses on the affordances of Twitter to build a network and facilitate social capital. Aspects such as the profile, the choice of who to interact with and how to present their ‘online presence’ in the network to access the community of practice and signal affiliations. How do the individuals use these affordances to identify and access the information and knowledge base in the profession? How does building of the network shape the individual’s engagement with the landscape and identify the sources of information?



- 2. How do teachers use the affordances of Twitter to increase their professional capital?** Having built the network to increase social capital this explores how the affordances of Twitter are used to manage the information made available. How do they enact information literacy practices in the information landscape to identify, store and extraction of information and subsequently communicate this to others? What modalities of information are more dominate in this electronic medium? What activities make up this literacy practice via Twitter – a social media tool?
  
- 3. Why do teachers choose this platform to build their professional capital?** This final question focuses on what the affordances of Twitter bring to the individuals' information literacy practice to improve their professional practice, particularly how they have increased their professional capital. While teachers may not be aware of the term information literacy practice, they are enacting it, through their decision to use this platform. What motivates individuals to engage in information literacy practice to connect them to the practice of teaching?

## 3 RESEARCH METHODOLOGY

### 3.1 Introduction

In this Chapter, I will explain how I used multiple interviews with four participants over 6 months. In addition to multiple interviews, I will explain how I collected tweets that the participants had produced according a set of criteria. These were used to inform the topic guide presented to the participants during the interviews. I will explain how this method of re-presenting tweets in interviews also allowed stimulated recall to overcome issues found during the pilot study.

Each method used in this study is explained and justified as well as considering how the pilot study informed these decisions and how they help answer the research questions. Finally, I will explain how the participants were recruited and selected as well as the ethical issues surrounding the use of online data.

### 3.2 Ontological and epistemological position

My ontological position is that ‘social phenomena and their meanings are continually being accomplished by social actors’ (Bryman 2011: page 710); there is not an objective reality, an individuals’ learning is related to social objects and their meanings. This also links back to practice theory that sees the actions and utterances of people are taken as representing their mental state and relation to the world at a given time, rather than individuals have an ‘inner mental state’ before doing or saying something (Schatzki 2017).

My epistemological position is that learning is a subjective achievement, and that individual actions related to learning have meanings for each learner that are specific to the context (Wenger 1998), therefore we must study them within that context rather than divorced from them. Practice theory also states that both the practice and the context are inextricably linked together and cannot be separated. Those actions are based on the meaning they have ascribed to them and the acts of

others (Bryman 2011). This means that the research methods that have been selected to answer the research questions are qualitative and these also leave open the possibility of unexpected findings (Bryman 2011).

Qualitative methods generally involve a small number of cases, and as such findings can be challenged due to the limited generalisations that can be made from the data. The need for generalisation in research has, however, been contested. Brinkmann and Kvale (2015) discuss this issue and raise the concept of analytical generalisation – ‘ a reasoned judgement about the extent to which the findings of one student can be used as a guide to what might occur in another situation ‘ (page 297) - leaving open the possibility of using research findings in another situation when appropriate. Brinkmann and Kvale (2015) also challenge Flyvberg’s (2006) misunderstandings about case study research, including the concept that context-independent knowledge (i.e. generalisable knowledge) is more important than context-dependent knowledge, and that it is difficult to develop general theories on the basis of specific case studies. Flyvberg (2006) cites the Lave and Wenger (1996) case studies on which the communities of practice learning theory has been developed. In this study, there is a small, selected sample so generalisations are not a priority from the data generated.

### 3.3 Data collection methods

My research questions required descriptions and explanations from the teachers involved, regarding their use of the affordances of Twitter to manage their social network and the information that they gain access to.

There were two main methods of data collection:

1. Collection of tweets from the participants involved
2. Repeated interviews of the participants over 6 months.

This section will outline the process of data collection using these methods.

### 3.3.1 Tweet data collection method

The collection of tweets involved several stages:

- Monitoring of the participants' twitter feed using an online platform carried out on a weekly basis.
- Selection of relevant tweets based on a set of criteria
- Storage of the tweets for data retrieval both during the interviews with participants and during data analysis.

Participants' Twitter feeds containing their own tweets, retweets and replies were viewed on a weekly basis to identify the relevant tweets based on the criteria. This frequency of collection made it easier to maintain consistent application of the criteria across all four participants and reduced the chances of relevant data becoming lost in the timelines. The number of tweets produced by each participant varied between as little as 3 tweets a week to over 100 tweets in a week. The larger number often came as a result of conversations between the participant and others in a chain. On average I collected 10 -15 tweets a week for the duration of the research. However, one participant did have a period of very low activity and had only 27 tweets for a four week period.

Initially, tweets were selected based if they met one of several criteria:

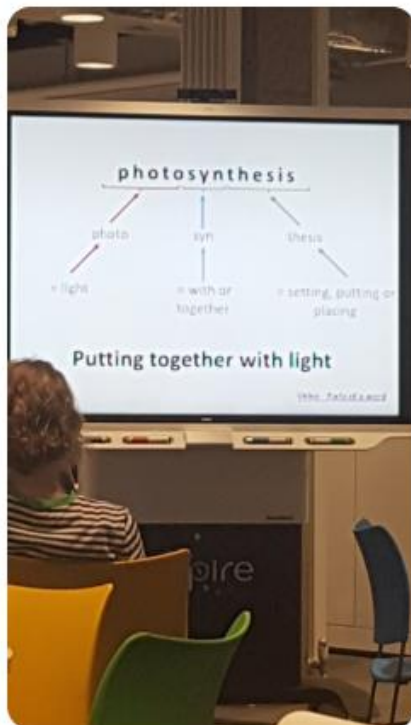
- Was the tweet about teaching, learning or professional practice? (Figure 3-1)
- Did it highlight something about the participant's learning? (Figure 3-2)
- Did it highlight something in terms of norms, languages, shared understandings e.g. jokes? (Figure 3-3)
- Did it provide something that was unexpected or unpredictable that may be useful in data terms? (Figure 3-4). For example, the use of Twitter for social action by one of the participants.
- Tweets participants felt were important to discuss in the interviews (Figure 3-5)
- Retweets of others that also fitted any of the above criteria.

I also actively excluded:

- Tweets where I had engaged directly with a participant through an organised chat (see section 3.7 below) and
- personal tweets, for example Figure 3-6 which is unrelated to teaching.

Figure 3-1: Example of teaching, learning or professional practice tweet

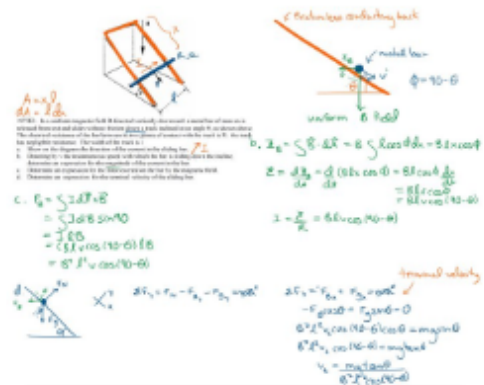
#cogscisci doh. I should have done this from day one. I have seen the light now.



10:24am · 29 Mar 2018 · Twitter for Android

Figure 3-2: Example of participant's learning tweet

Since apparently no one has this, I figured I could put my attempt out there. Would someone else try 1973 #APphysicsC E&M #3 or let me know where I'm wrong?



4:47pm · 15 Apr 2018 · Twitter Web Client

3 Likes

Figure 3-3: Example of joke tweet



Figure 3-4: Example of social action tweet



Figure 3-5: Example of tweet important to participants

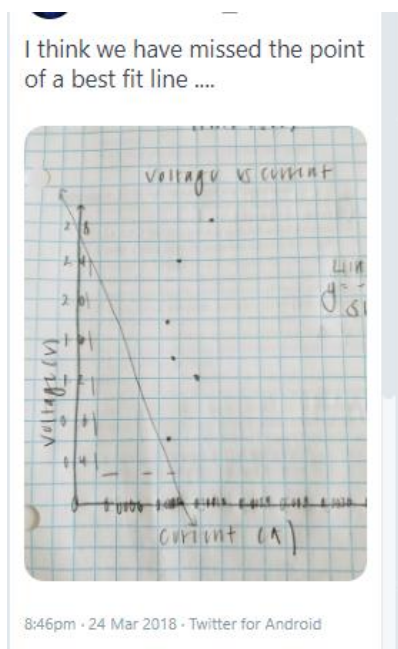


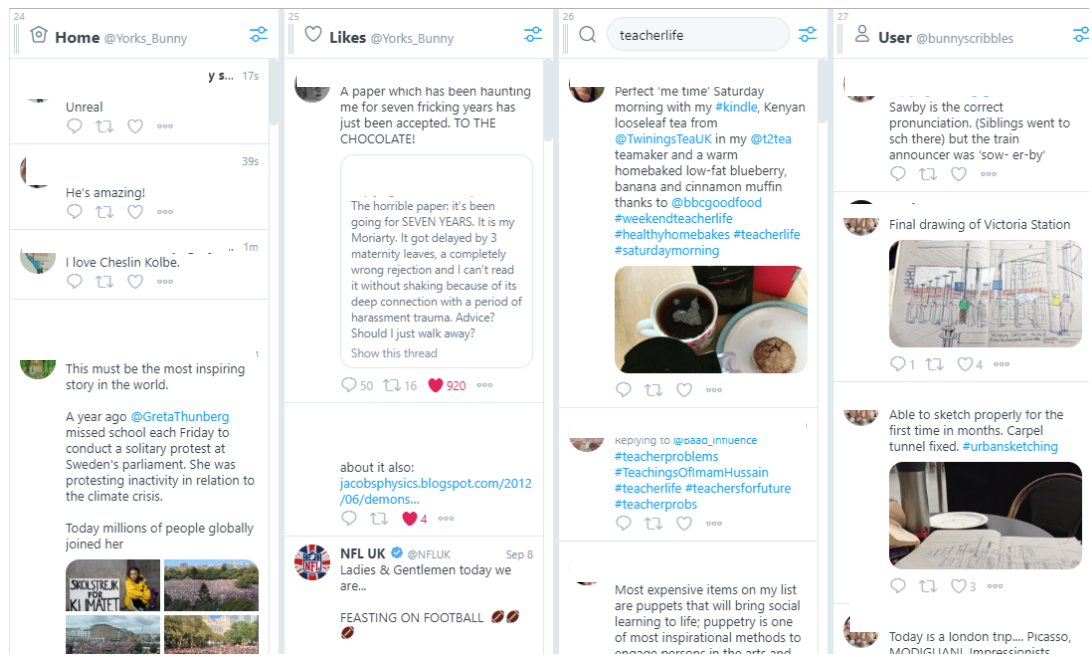
Figure 3-6: Example of tweet unrelated to teaching



The tweets that were selected, were stored using an online platform – Tweetdeck. This platform allowed me to both view the timelines of the participants, but also to store the selected tweets in a collection. These 'collections' were organised by date

within the collection and named by participant. This allowed easier retrieval of data throughout the research process including their use during preparation of interview topic guides. An example of Tweetdeck's layout is shown in Figure 3-7 and Appendix G.

Figure 3-7: Example timeline



All participants started the study with open, publicly available accounts. This means that anyone can see their tweets both within the platform but also by using search functions such as Google. Only one participant had more than one account and that participant swapped one of those to a locked account halfway through the study. She consented to the continued use of this account for the research.

All participants were aware of the purpose of the research and that I was undertaking observation and collection of their tweets. Bearing in mind that they are aware that their followers are also looking at their tweets, individuals were more likely to focus on presenting their persona on Twitter (Zappavigna 2012) and the research was just an additional factor in this.

### 3.3.2 Interviews Data Collection Method

The initial plan was to interview each participant about every 4 weeks. In practice, this was modified dependent on the participant and their availability. For one

participant it was more difficult to ensure the schedule was kept, however, the data provided in the less frequent but longer interviews proved useful.

I carried out the initial interview with each participant using Skype<sup>®</sup>. This was digitally recorded and stored with written consent from the participant concerned. Each participant was at their home and the majority of skype calls were video calls unless the participant chose to make it audio only (one person) or there were poor connections interrupting the interview. The decision to make video calls rather than audio was that of the participants rather than the researcher. However, the use of video makes it easier for me as a researcher with auditory disabilities as there were more visual cues to support my interviewing skills. The visual element of the interviews was not analysed, only the auditory element. For Beth, in the USA, I ensured a consistent time for each interview to cater for the time zone difference of 6 hours and family needs. For the others, this was a less significant issue and all interviews were scheduled relatively easily. There were issues with interruptions from children or family members, however this did not cause early termination of any interview.

The most difficult aspect was ensuring that the participants remembered the time for their interviews, and, on several occasions, individuals missed their allotted time and had to be rescheduled for another within a week. For one participant the delays in scheduling interviews meant that the subsequent interview was longer with more to talk about.

The interviews followed a similar format; the initial interview explored the context and history of the participant (see Appendix E for topic guide). Of interest were the activities that they were involved in both around Twitter and offline including professional associations and training activities outside of their own teaching role. The questions were open ended allowing me to follow up where required and this was particularly needed when discussing issues around different curricula such as the USA and Scotland.

Each participant was asked to 'talk me through your Twitter feed' from the past month to allow them to bring up those tweets that they felt were important. This



meant that I did not limit the discussion to those that I thought were important and had selected from my weekly analysis but allowed them to identify and include ones that were significant to themselves in their context. Any additional tweets that the participant felt were important were added to the 'collection' for storage, as seen in the screenshot in Appendix G. The tweets I had collected informed the topic guide to discuss with the participant regarding their information activities and use of Twitter.

Subsequent interview (see Appendix F for topic guide) had more varied questions that were specific to the individual concerned and focused on the participant's interactions with others and their specific tweets. Participants were asked about their context, any changes or challenges they were facing in their professional work and in their use of Twitter. This allowed me to gather data about the changing context of the participants, rather than assuming the context was unchanging.

The second aspect of the subsequent interviews was again asking participants to talk through their Twitter feed. The topic guide for these was based around the selection of tweets I had selected since the previous interview. I then asked follow up questions or questions about specific tweets that I had identified prior to the interview.

## 3.4 Justification for Methodology

This section outlines the impact of the pilot study on the research design and the justification of these choices.

### 3.4.1 Pilot study and impact on methodology choices

The pilot study (Golton 2016) was undertaken using a single participant to trial the interview techniques involved in this study. This was fundamental as in the previous research papers in the EdD I had not interviewed individuals. (See Golton, 2016 for full details of the pilot study). The pilot study influenced the subsequent study in several different ways.

Firstly, was the importance of understanding the context of the individuals concerned, highlighting how much of the context influences their use of the affordances of Twitter and what information they are seeking. Factors such as experience, position, the ability to connect with relevant people and the usefulness of the information were all identified. This led to the focus in the interviews on the context and its importance in the information literacy practices for the participants.

In the pilot study, the participant was interviewed about their Twitter use, but initially without their feed in front of them. This identified how difficult participants found to recall tweets or activities around their Twitter timeline without having the feed to stimulate the recall. The pilot study participant struggled with recall of activities and the associated judgements around their tweets that were further back in time. Both these issues led to the development of using the tweets as a topic guide for interviews as it had not been used this way in the pilot study. It also to provide stimulated recall for the participants as they could talk about their use and information literacy activities around particular tweets. The struggle to recall further back led to the repeated interviews approach, whereby individuals would only have to talk through the previous months data capture, reducing the difficulties round recall many weeks after. However, this approach also has limitations associated with recall and reinterpretation of the context due to hindsight (Bryman 2011, Flick 2014). This is shown in cognitive psychology research into memory and recall as outlined in Eysenck and Keane (2010).

The pilot study also highlighted how time-consuming interviews were both to carry out, transcribe and analyse. This influenced the decision to include a very small number of participants using multiple interviews, rather than a higher number of participants and single interviews.

### 3.4.2 Tweets and stimulated recall

The collection of 'Tweets' is documentary evidence. Yin (2018) raises the issue of volume of documentary data available and cautions against getting lost in it. To prevent this, the researcher needs a strong focus and even a triage element to focus data selection. In this research, the tweets are presented back to the participant to explain their thoughts and actions surrounding them – this is an

example of stimulated recall (Yin 2018). Therefore, having a clear set of criteria for using tweets in the interviews is important to allow for cross-case analysis.

Tweets were then presented to the participants during their interview. This had two purposes; firstly, to support the retrospective recall of individuals, and secondly to also allow participants to talk about their actions on Twitter – what they tweeted and why. This facilitated freedom for the participants to select those tweets that had specific meanings or actions behind them. This allowed more flexibility than simply talking about my own selected tweets, as often those selected by the participants had specific meanings to them.

### 3.4.3 Repeated semi structured interviews

Lloyd (2014) states that ‘researchers must follow information as it is encountered, created and circulated within a setting’. She acknowledges that getting local knowledge used at the moment of practice can be a challenge and is easily missed. Lloyd (2014) describes a method called ‘interview to the double’ which has the potential to

*‘Allow participants the opportunity of articulate and (re)present their awareness and understanding of information and information literacy practice along with the activities and skills that compose that practice, from the ground up. It does so by allowing the participant to reflect on what is important to him or here, and provides an opportunity to draw from local knowledges’ (page 102)*

This meant that I needed to follow and interview participants over a period to follow the information as it circulates in the setting to gather tweet data. The interviews provided an opportunity for the participants to reflect on what was important to them in the data, articulate their understanding of the information and the activities and skills involved.

If interviews were left until after extensive Twitter data collection, then this increased the demands on participants’ ability to recall and re-interpret their

actions, so the decision was made to do multiple interviews in order to both follow the information over time, and allow deep, multiple opportunities for reflection, as well as explore changes over time in their practices.

All interviews were semi-structured with a set of specific topics to be asked. These topics were selected based on the research questions, but also after selection and review of the participant's tweets. Bryman (2011) emphasises the fact that this type of interview is flexible and allows the interviewer to pick up on things that have been said by the participant, unlike a fully structured interview. This is backed by Kozinets (2015) who recommends the 'depth' interview approach which is 'much more open ended, free-flowing, conversational and discovery orientated' (page 187). This allows the interviewer to ask probing and clarifying questions and stay open to interesting points and elaborations. The flexibility for participant responses and interviewer questions allowed me to follow up on the participants' understanding of issues and events. An important aspect was also being able to clarify the motivations behind actions such as retweeting, sharing resources or links, and different tweets that were posted.

In contrast with unstructured / in-depth interviews, the use of semi structured interviews also provides structure to facilitate the cross-case analysis aspect of method. Flick (2014) defines a longitudinal study as when 'the same method of data collection is applied repeatedly to analyse how things have changed over time, in the issue' (page 128). This is the most appropriate approach to answer my research questions as I was looking at events over time.

Brinkmann and Kvale (2015) discusses the important skills for a successful interviewer, including asking clear questions, allowing pauses, and giving people time to think. Bryman (2011) also adds two other skills – being balanced, so the participant has space to talk rather than being dominated by the interviewer, and being ethically sensitive – ensuring that the participant understands what the research involves and that the data produced is confidential. This was a skill I had to develop quickly to ensure that the participant did have time to talk and expand on their thinking without interruption. The use of video calls supported me in

developing these skills considering my auditory processing issues by allowing visual cues as well as auditory ones.

Focus groups were not selected for this study for two reasons – the geographical spread of participants and the difficulty of facilitating multiple focus groups with the same people. The research focus on Twitter means that the participants do not need to be within the same geographical area, making it logistically difficult to run focus groups. The possibility of online focus groups was considered but I felt that this would not necessarily allow me to dig into an individual's perceptions the way that a single person interview allows. Single person interviews also allow participants to speak more freely than in group interviews, especially when talking about more sensitive topics, such as other individuals or conflict. In addition, the research questions required data about change over time and whether strategies and approaches adopted by participants had worked out as expected. Having focus groups at a single point in time would only give a snapshot of practice. Trying to ensure that the same people are available for multiple focus group session is very difficult, whilst using different people in each focus group would change the group dynamics each time (Yin 2018) and therefore impact on the focus of the discussion.

An ethnographic approach was not selected as I focused on the individual concerned as my unit of analysis or case (Yin 2018). The relevant context boundary was not clear in Twitter as it is a largely unbounded digital landscape, therefore making it more difficult to conduct this type of research. Ethnographic research requires the researcher to be part of the group and I was not a full participant member of the groups, but an observer of their interactions within their network. For the research I wanted to remain as a periphery member of the participants' networks, rather than a key player in them to limit my influence in the data produced.

### 3.5 Minimising my impact as a researcher

As a teacher who also uses Twitter, I am an observer of the events as they unfold. I have a detailed knowledge of how Twitter works, and this is important in shaping my research analysis, findings and the themes that emerged. I am also active in the Association for Science Education (ASE) – a national organisation for Science teachers, that organises conferences and events regularly.

As a researcher I had to negotiate to keep teacher, colleague, and researcher activities separate. The nature of Twitter and science educators on Twitter means that it is a group of teachers who often know or know of each other through the social network and involvement in Twitter chats related to science education and through the UK wide professional association, the ASE. As a result of convenience sampling via Twitter I had met two of the participants at the ASE conferences previously. Had more participants been available I would have chosen not to use those I knew personally, but this was not possible with numbers available.

I deliberately chose to avoid engaging in Twitter discussions with the participants during data collection as far as possible but remained an observer of the network. There were only two occasions, on an organised chat (ASEchat), when this was unavoidable as both one of the participants, Stephen and I engaged in the discussion with others. These were not tweets that I explored in further research interviews.

### 3.6 Subjects and settings

In this section I give a short discussion of the number of participants and how the participants were recruited to this study. I then briefly describe each of the participants in their physical and Twitter settings.

#### 3.6.1 Number of Participants

A multiple case study with interviews over time is resource demanding, and as such a decision was made to use a maximum of 5 participants. The number of

participants was aimed at achieving a balance between recruiting more participants to increase the robustness and diversity of the data and the practical issues of the number of interviews required. The focus of the research is on a deep understand of meaning and decision making. My approach was to look at an individual's actions, such as their use of tools, and the development of their professionalism in their context. Therefore, a smaller number of participants will allow this. A 6-month study with 5 interviews per person (potentially 30 interviews) was feasible for me to deliver.

### 3.6.2 Participant Recruitment

Participants were recruited by me producing a short 'Tweet' asking for people who would be interested in participating in the research project. This was done three times over the space of two weeks in February 2018 (see Appendix B for recruitment tweet). The tweet asked people to 'retweet' it to gain a wider audience rather than just my own followers. It was retweeted 56 times over a two-week period to widen the possible participant pool. I also tweeted with the #ASEChat hashtag attached at the time of the organised chat to increase the number of individuals who would see it who did not follow me. The initial response showed 35 people were interested. I then examined these participants' 'Tweets' to see if they would be suitable to produce data. The criteria for selection was:

- Teaching Secondary or equivalent Physics / Science, preferably in full-time posts, not supply teaching. The choice of science teachers ensured that I knew enough about their practice to ask questions about it and understand their responses as we shared some common language and understanding of the practice. This is particularly important as science teachers undertake a large portion of practical work that other teachers do not engage in. The use of other subject teachers, such as English teachers would have increased the likelihood of misunderstanding and misrepresenting their practices due to my lack of knowledge of their subject.
- Engaged with Twitter as a tool for their professional development, so tweeting about educational practice and their own classroom practice. This was done by viewing the individual's timeline and assessing that at least

75% of their Tweets were education related in order understand their professional practice.

- Producing a high enough volume of Tweets. This means that they were interacting with others on, at least, a weekly basis which would enable enough data to be collected over a period of 6 months.
- Had been using Twitter for at least 6 months prior to the start of the research to have previous tweets to look at and evaluate for selection and indicate a sustained involvement in Twitter that would continue for the duration of the research.
- Had at least 50+ followers and following, to ensure a range of input into the participants' timeline and a developing network could be seen.

From the original 35 participants, 15 fitted these all these criteria. These participants were then sent details of the research (See Appendix C for participant information sheet). After this, five participants still showed an interest and were recruited. One of these subsequently withdrew as they left their teaching position and retired. The nature of the time frame of the research over 6 months was the main reason for individuals deciding not to participate.

The sampling process of was initially purposive sampling (Flick 2014) with a set of criteria listed above. Schreier (2018) describes this sampling technique as 'to select instances that are information rich with a view to answering the research question'. The initial round of criteria shows that fifteen people fitted the purposive sampling. The individuals that took part were then selected based on convenience sampling as they were the only ones to volunteer when fully informed of the research. This means that the sample were homogeneous in relation to the initial criteria but were heterogeneous in other respects such as location and education system. Schreier (2018) states that this strategy is useful for exploring a phenomenon in depth, as this research aims to do. The remaining selection process was convenience sampling, where only 5 participants were able to participate and then this limits the generalisations that can be made to the wider population of teachers. Yin (2014) discusses replication logic in multiple case study designs and the individuals were selected based on literal replication, predicting similar results. This



is different from sampling logic, where inferences are made about the population. The aim of this research was not to generalise to the population, but to gather evidence of information literacy and social capital in a setting. Returning to practice theory and information literacy – they are context dependent so would not be generalisable, hence the use of case study methodology.

### 3.6.3 The Participants

The resulting sample consisted of 3 women and 2 men. One participant withdrew from the research after retiring, her data is not used in the final analysis. Of the remaining four participants, 2 individuals were based in the English Education system, 1 in the Scottish and the final participant was based in the USA. This was simply the way that the convenience sample ended up and they are a fair representation of active Twitter users who fitted the initial criteria.

The choice of inclusion of an individual from the USA was made because the opportunity presented itself in sampling. I included 'Beth' to identify any similarities or differences between her use and the use by teachers in Europe. This was not something I initially planned for but did prove useful as the research progressed. In addition, it emerged quickly that Beth operated two Twitter accounts, one under her real name and the other under a pseudonym. Again, this was something that I did not expect, but felt the opportunity to explore it could not be ignored.

There are of course, limitations with such a small sample size and the use of convenience sampling at the end of process. There was no intention of conducting the study to be able to generalise to a wider population, but to explore a phenomenon in one context and as such this is a limitation. Convenience sampling can produce a bias however, the purposive sampling earlier in the selection procedure allowed a selection of homogeneous group with some heterogeneous characteristics. This, again, means that we cannot generalise to a wider population of teachers who use Twitter, particularly across cultural and technological boundaries and the findings are dependent on the context in which they were collected. What may work on Twitter, may not work in Facebook with different affordances therefore we cannot apply these to other social media platforms. Access to Twitter can be restricted or perceived differently so cultural

generalisations are not possible. Therefore, the main limitation of this research is the generalisation to the wider population of teachers on Twitter and to the Twitter population in general.

### 3.7 Case Study

The multiple case study is a time demanding approach (Yin 2013) and was not undertaken lightly. However, this approach was important in helping to answer the research questions about contemporary events that I had no control over.

#### 3.7.1 Cross-case analysis overview

This section provides more details of the case study approach including cross-case analysis overview and the three levels of case study analysis. This study is an intrinsic case study, focusing on a small group of teachers involved in Twitter.

Yin (2013) describes the concept of cross-case analysis as comparing any within-case patterns across cases, while retaining the integrity of each of the cases. This approach was chosen to ensure that the context in which a participant was working was clear, but patterns across cases could be identified and analysed.

#### 3.7.2 Data analysis

All interviews were recorded using Skype<sup>®</sup> recording software and stored as digital audio and video files on a password protected computer. Each interview was then reviewed, and notes made using the NVIVO software. Initially, full transcription was considered; however, a decision was made to make notes on the discussion and initial coding with time stamps and then go back and extract the key quotes as the analysis proceeded. Noting details with time stamps produced during the data collection period was time consuming but allowed me to identify the themes which supported the data analysis and follow up further data collection in subsequent interviews as I progressed. As stated by Bryman (2011), transcription and analysis should be an ongoing activity during data collection as this informs the subsequent interviews in this research.

All coding was undertaken on an Excel spreadsheet with coding categories across the top and the participant tweet collection and interview down the side.

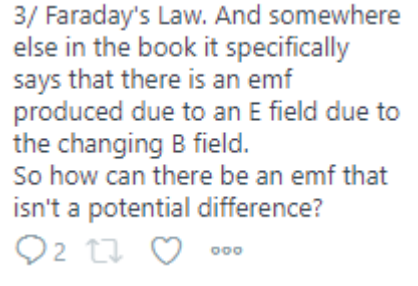

### 3.7.3 Qualitative coding round 1 – Initial coding of tweets



Tweets were coded for their content before each interview. Initially, this began with the codes in italics, developed from the pilot study. The remaining ones added as coding continued. The codes were added until saturation point when all the data had been processed (Yin 2018). This initial coding provided a way of identifying the common content within tweets both within the participants involved and across the participant group including information sharing and use of the affordances of Twitter. This provided clarity in the purpose of the tweets that informed the topic guide for the interviews. Each participants data (tweets) was coded separately before the interview so that they could be presented to the participant as stimulated recall. Additional coding was also undertaken after the interview where additional tweets highlighted by the participant.


Codes that developed from this initial content coding included:


- *Asking for help*
- *Sharing resources*
- Promotion of event
- Humour
- *Sharing information*
- *Requesting information*
- Discussion of other teachers
- Discussion of students
- *Discussion around practice*
- Attending or running events
- Retweeting
- *Other online affordances eg cloud links*
- Hashtags
- Images
- Videos

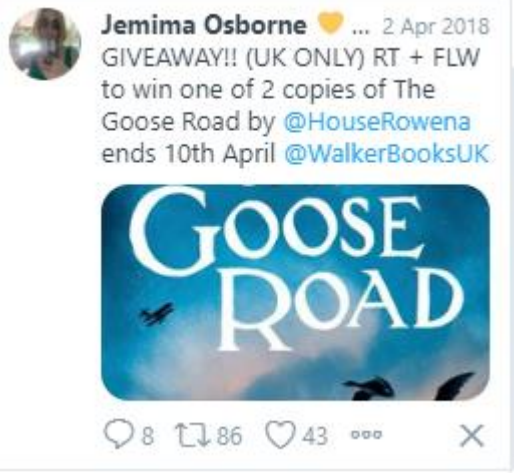

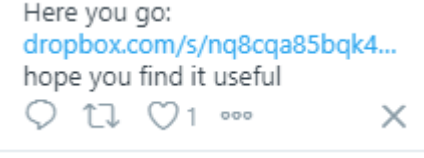

Table 3-1: Categories of Initial Coding from Tweets and Interviews

Category	Example from Tweets	Example from interviews
Asking for help	 <p>3/ Faraday's Law. And somewhere else in the book it specifically says that there is an emf produced due to an E field due to the changing B field. So how can there be an emf that isn't a potential difference?</p> <p>2 19 1 000</p> <p>Beth</p>	<p>I needed a lesson plan late in the day - interview lessons igneous rocks, asked someone about it and within seconds I got a reply - Dev</p>
Sharing resources	 <p>@MrBlachford Had go at mastery booklet <a href="https://dropbox.com/s/z0ky6fhiygqv...">dropbox.com/s/z0ky6fhiygqv...</a></p> <p>8 19 90 000 X</p> <p>Dev</p>	<p>I don't share resources often, can't remember where they come from. - Dev</p>



<p>Promotion of event</p>	<p>I'm superbly excited about speaking at this fantastic event- plus there's cake- lots of cake 🍰 🍰</p> <p><b>Jenny Holder</b> @JennyHolderLiv  <a href="#">#BrewEdWigan</a> 11-3 on 9th June featuring an amazing line up- @Snotlady5 @sleepybearjour @drewfoster0 and the wonderful Jim Holian (my first headteacher when I was an NQT!!)  <a href="http://eventbrite.co.uk/e/brewed-confe...">eventbrite.co.uk/e/brewed-confe...</a></p>  <p>Show this thread</p> <p>1 6 11</p>	<p>Preparing for Pedagoo Muckle - delegate goodie bags and preparing the direction signs - both working on the behind the scene event. - Stephen</p>
<p>Humour</p>	<p><b>SP The Sunday Post</b> @Sunday_Post</p> <p>Tunnock's to sponsor Nasa parachutes on landmark mission to Mars <a href="http://buff.ly/2E9P0Is">buff.ly/2E9P0Is</a></p>  <p>9:22am · 1 Apr 2018 · Buffer</p>	<p>A science teachers' life - holding two bananas - watching bobs burgers - laughing at the scene is just... tweet - most engagement, most clicks - Dev</p>
<p>Sharing information</p>	<p>Replying to @TeamScienceEdu @doc... @littleangelmm86 🍌 @mrbartonmaths has some great tools to use in classrooms- not just for maths teachers either- lots can be adapted for science 🍌 🍌</p> <p>2</p>	<p>It's my favourite practical so I have to share it so primary see it might try it - Rachel</p>

	Rachel	
Requesting information	<p>Alright #edutwitter, I'm helping with a hyperdoc for new teachers with a bunch of linked resources (admin stuff, policies, etc.) and want some links for the great homework debate. Do you have any favorites? I'll also take lists of strategies, classroom management, etc. for HS. 😊</p> <p>🗨️ ↻ 3 ❤️ 6 ⋮ ✕</p> <p>Beth</p>	Asking for advice about the textbook depth of question - did students have to know it or was it just a 'depth of knowledge' not required - Beth
Discussion of other teachers	<p>Ofsted didn't send this email. Gove, Morgan, Greening, nor Hinds sent the email.</p> <p>A teacher sent it. To another teacher.</p> <p>Sometimes looking inward and seeing our own faults is important.</p> <div data-bbox="517 1104 906 1585"> <p><b>Tom Rogers @RogersHistory</b> A very anxious and stressed maths teacher received these emails last week. IMO email picking apart display boards (pics) and comparing to another dept is unprofessional. Its lines like "i'll delay your finish time if..." in the 2nd one that kill this profession.</p>  </div> <p>Dev</p>	There was a thread about terrible colleague - awful teacher. No labs, gives worksheets, talks about it but hides incompetence - Beth

<p>Discussion of students</p>	<p>Two of the most well behaved students doodle all throughout the cover lesson. I get back a page of doodles.</p> <p>But being the lovely kids they are they have their names on it.</p> <p>I laugh and give them a ribbing and worked to find out how to make cover lessons better.</p> <p>🗨️ 1 ↻ 🍷 1 ⋮ ✕</p> <p>Dev</p>	<p>A kid had made a mistake on a test - pencil lines had erased a completely correct answer - painful to do that. He is not a super nice child to me; cannot give account for it.</p> <p>Easiest to ignore when he isn't the nicest child. - Beth</p>
<p>Discussion around practice</p>	<p><a href="#">@Mr_P_Hillips</a> Absolutely agree- I would love more time with my class. I've decided to start to use <a href="#">@VerbivoreTeach</a> resources with my year 7 classes this week as we introduce science specific vocab for our ecosystems topics 🥰🥰</p> <p>🗨️ ↻ 🍷 1 ⋮ ✕</p> <p>Rachel</p>	<p>Gluttonous - they have filled in a sheet - examples. Picture and contexts. Use it with year 7 with science vocabulary. Ppt produced for free so modify so can change for secondary. Rachel</p>
<p>Attending events</p>	<p><a href="#">#rEDRugby</a> For those new to CLT, <a href="#">@ShibliDom</a>'s session is well good.</p>  <p>🗨️ ↻ 🍷 7 ⋮ ✕</p> <p>Dev</p>	<p>Hartlepool - won a ticket via Twitter, used to teach up there. Rachel</p>

<p>Retweeting</p>	 <p>Rachel retweeted</p>	<p>she often tries to win books by retweeting on Twitter to build the class library up - Rachel</p>
<p>Other affordances eg cloud storage</p>	 <p>Beth</p> <p>Here you go: <a href="https://dropbox.com/s/nq8cqa85bqk4...">dropbox.com/s/nq8cqa85bqk4...</a> hope you find it useful</p>  <p>Dev</p>	<p>Dropbox link - energy booklet, - Dev</p>
<p>Hashtags</p>	<p>Back to planning for me today- electrolysis first thing on Monday closely followed by electromagnets, neutralisation and then some fantastic Chemistry revision! Whooohooo!! <a href="#">#TeamScience</a></p>  <p>Rachel</p>	<p>Hooked up to Tweetdeck - columns, ASE chat, UKEdChat, PhysEd, Following, hashtags, flicked through the hashtags on the way to work. - Dev</p>



<p>Images</p>	<p>All saved from two boxes of old stuff, plus 1/4" speaker wire, banana leads and some stranded wire. And so so many computer chips.</p>  <p>1 2</p> <p>Beth</p>	<p>always have a picture. Use pictures - they see the pic as its bigger pixel footprint than text and get bigger likes. Glow sticks - picture - instantly saw it. - Dev</p>
<p>Videos</p>	<p>It's always nice rediscovering resources you forgot you had :) Doug Stith has a great Lenz's Law demo in this video I'll be using for #APphysicsC:</p> <p><a href="https://www.youtube.com/watch?v=LDZjpE...">youtube.com/watch?v=LDZjpE...</a></p>  <p>1 1 13</p> <p>Beth</p>	<p>Animations are brilliant - physics gifs is so useful - Dev</p>

### 3.7.4 Qualitative coding round 1 – Initial coding of Interviews

Interviews were also open coded, and codes were added until saturation point (Yin 2018). This provided evidence of commonalities across the group, related to the affordances of Twitter and information literacy activities such as information seeking and sharing. Additionally, codes relating to relationships between individuals, stories, subject specific terms, and understanding underlying meanings and emotions. Each interview was also coded before the next interview to identify any data that may need following up in subsequent interviews. As a starting point, the interviews were coded using the same codes as used for Tweets (see Table 3-1 above for example).

In addition, the codes stated below were used:

- Context information
- Frustration
- Conflict
- Expertise and experts
- Joining Twitter
- Personal relationships off Twitter
- Key people
- Profiles
- Anonymity/ identity
- Practices used in the classroom
- Retweeting
- Bookmarking
- Sharing
- Other communities eg professional associations
- Hashtags
- Images
- Direct messaging
- Promotion of activities and blogs
- Use at face to face events

Table 3-2: Further Examples from Initial Coding from Interviews

Category	Example
Joining Twitter	Joining twitter – I cannot remember much - I think my wife had joined before and using it. I joined it because it seemed to be a type of social media that seemed to fit with what I wanted to use if for. - Stephen
Context	I've been teaching for 12 years, same school in an affluent suburban area east of XX area and I've taught Physics and conceptual physics - Beth
Frustrations	*head desk* - the reason I tweeted that - another example of someone who doesn't understand how the maths higher tier paper is structured - G4-9. - Dev
Conflict	'Twitter is more tribal - Rachel
Expertise and experts	Getting information useful for research viewpoint - Dylan William - posts links to research papers and other things - and his own - Dev

Personal relationships off Twitter	DB is really good, he's one that I know locally as well. He runs our physics support program but he only does mechanics, - Beth
Key people	NB has answered a lot of my stuff and then also Sara - she's physics - SJ she is at a university up in Canada and she has been really helpful - Beth
Profiles	Beth open is the one associated with my district, is the one associated with my position within the physics group so that's the good things, its associated with the blog that I help write as well so its things that I don't mind being public and traced back to me - Beth
Anonymity	People recognise name and not faces - familiar with name. RW - not her real name, pseudonym - Dev
Bookmarking	only just learnt to bookmark this week - Dev
Other communities of practice	It first is started when I was appointed as teacher network coordinator - Stephen
Direct messaging	Someone who private messaged me to warn me about the people and not to get into it - Rachel
Use at face to face events	I went to the National Meeting but in the winter, which is smaller and it was the first time I'd ever been and I would meet people and they would go 'oh, What's your twitter handle?' And I'd go I don't have one so I made one right there. - Beth
Following	Beyond that - some of the ASE crowd - Richard so I have broader perspective in England - Stephen
Conflict	I am just grumpy today, nice twitter exchange. - Dev
Discussions around students	A kid had made a mistake on a test - pencil lines had erased a completely correct answer - painful to do that. He is not a super nice child to me; cannot give account

	for it. Easiest to ignore when he isn't the nicest child. - Beth
Other apps/digital links	An app that allows me to download videos - Beth
Rejecting practice	No way on earth going to try - mantle of the expert, most of the stuff on Pedagoo - Dev

### 3.7.5 Qualitative coding round 2 - Coding for Social Capital

The second round of was taking the qualitative interview data and matching it to the key features of social capital. These codes were defined by the Naphiet and Ghoshal (1998) model of social capital. Tweets were not coded as this it was the meaning behind the tweets revealed in the interviews that was coded. This mapping of the data to the key features allowed me to identify if the data supported the use of this model or not. This was undertaken during the later stages of the data collection.

Codes included from the model were:

- Network ties both strong and weak
- Network configuration
- Appropriate organisation
- Shared language and codes
- Shared narratives
- Trust
- Norms
- Obligations
- Identification
- Access to parties
- Anticipation of value
- Motivation
- Combination capability

Table 3-3: Examples of Coding for Social Capital

Category	Example
Network ties	Engaging with ed researchers via twitter - that is where the research aspect - following those key people - Andy Hargreaves, carol Campbell people like that looking at how you improve professional learning and deliver learning activities. From IOP teacher network aspect and ASE organisational aspects of research - Stephen
Network configuration	So, there's been people who would help me in the fall and now, it's like looking for more people with the E and M and find that the collegiate people actually respond a lot more - Beth
Appropriate organisation	DB is really good, he's one that I know locally as well. - Beth
Shared language and codes	Amber works LHC and LIGO and she is online and offers a lot she used to be in the classroom she is a big proponent of doing modern physics in the class - Beth
Shared narratives	The editorial cartoon making the rounds for years - shows a parent teacher conference in 50s and teacher hands the parents a failing grade and they turn to the kid - explain this to me, and then modern - showing the grade to the teacher and saying explain this to me and the kid the one looking all smug. That really has been the change - Beth
Trust	Share more resources in the Cog Science group. Feeling of who do I trust. - Dev
Norms	Flying cups video that is going on twitter; doesn't have your faces on. - Beth Take it and put it up on TES and charge for it. Never meant to be charged and for everyone. - Dev
Obligations	Yeah exactly and that is one of the reasons I have been so forthcoming with people because I remember being a new teacher and this was before TpT (Teachers pay Teachers), before Pinterest and I just would search all night looking for stuff possibly for the next day because we are not given anything - Beth
Identification	Cog Sci group - very difficult to organise things for it. All 'get me' and I get them, met them in real life. - Dev
Access to parties	Engaging with ed researchers via twitter - that is where the research aspect - following those key people - Andy Hargreaves, carol Campbell people like that looking at how you improve professional learning and deliver learning activities. - Stephen

Anticipation of value	Really nice because we don't talk about people but about pedagogical techniques. - Dev
Motivation	Twitter - more immediate in getting a news feed and see this as its tool - Stephen
Combination capability	lots of stuff I've tried out, not always science specific but more about language and literacy. - Rachel

### 3.7.6 Qualitative coding round 3 - Coding the affordances of Twitter

The third round of coding was taking the qualitative data and matching it to the affordances of Twitter, both the tweets and the interview data were matched to this. This was done with the complete data as a follow up on coding round 1 and 2. This allowed matching of the data to affordances that allow the development of social capital.

Codes included:

- Likes
- Retweets
- Anonymity
- Following
- Followers
- Direct messaging
- Character limit
- Hashtags
- Images
- Profiles
- Muting
- Pinned posts
- Blocking
- Tweeting
- Bookmarks
- Links to cloud storage
- Links to blogs or internet sites
- Links to documents

Additional category examples are shown below.

Table 3-4: Examples of Coding for Affordances of Twitter

Category	Example
Character limit	I didn't like that but not enough room to explain why but I wanted to show my frustration to the people who would understand me

Profiles	Also lost ability to ask questions of my peers. Not feel can't ask that on there. Changed to private settings, but don't know if they made an account just to follow me.
Muting	Jack muted his own conversation in the end because he had so many notifications
Pinned post	pinned Tweet - mastery booklet for work done
Blocking	I blocked more this year alone, than since started in 4 years
Hashtags	Kids found public acct with some tweets like this, funny things. Of course, hashtag teacher problems.
Other platforms	Dropbox link - energy booklet,
Retweeting	retweeting might make the person in charge a little happier.
Bookmarking	Add to bookmarks on the tweets - liking tweets for research - does this change the tweets and bring more in. Only just learnt how to bookmark this week.
Tagging	I will tag in the guy who I got that from so he knows that we are using what he is talking about.

### 3.8 Ethical considerations

There were two main ethical issues for this study. The first was ensuring that all participants understood the nature of the research, gave informed consent and that confidentiality was maintained throughout (Flick 2014). All potential participants were sent a participant information sheet and an informed consent form (see Appendix D) to sign by email. All were encouraged to ask questions prior to signing the form if they needed further information. Those that returned signed forms then had their first interview at which it was again confirmed that they were happy to take part. All participants were made aware that they could withdraw at any time. Following the Data Protection Act 1998, all information was treated confidentially

with participants assigned a pseudonym (Flick 2014). Signed consent forms were kept separate from the main data information and only pseudonyms were used on the data collection resources.

The second ethical consideration was the use of Tweets. In an unlocked account these are in the public domain so anyone can access them. In practice, as Tweets are combined with interview data, I did ensure that the participants were aware of this and that I did have their permission to use them. A second concern in the use of publicly available Tweets is the ability of someone to 'find' the tweet using the internet and put at risk the confidentiality of the participant. Tests showed that it is incredibly difficult to 'find' the tweet. However, Tweets are anonymised where possible to make this even harder to find. I made the participants aware of the fact that it was not always possible to retain that anonymity and that the tweets could be tracked back to them before they agreed to participate. This was also the reason for the use of open and publicly available accounts as individuals have made the decision to tweet publicly, rather than restrict access.

There is an ongoing ethical discussion surrounding the use of such publicly available data. For example, Manca and Whitworth's (2018) literature review describes several such research projects where this was a factor. Kozinets (2015) has a whole chapter on the ethics of netnography. He points out that 'every decision in netnography has ethical ramifications, both what to include and what to exclude' (page 137). He also raises the fact that analysing communications from online archives is not human subject research. In the case of this research, the interview element meant that I had to gain informed consent anyway rather than implied consent, therefore I sought informed consent for use of the Tweets as well.

The ethical guidance and rules are constantly changing and being updated in light of the changing digital landscape. When this project was carried out, I followed the key guidelines by Kozinets (2015) including:

- Clearly stating my name and the purpose of my research



- Being honest with the participants
- Using my profile to state the research I am interested in
- Asking permission from participants about several aspects including use of blog posts.
- Obtaining written consent for interviews
- Every effort being made to 'cloak' the individuals minimising the ease with which data can be traced back to them.
- An awareness that full anonymity could not be assured in this research.

(For a full discussion of online ethics see Kozinets 2015)

This study was granted ethical approval by the University of Manchester prior to its start.

## 4 DATA ANALYSIS

In this Chapter I will initially present a narrative of the four participants in turn to place each in their context as this is important in understanding the data. I will then analysis the data through consideration of each research question.

Table 4-1: Overview of Participants

Participant	Beth under her own name <i>(Beth under a pseudonym)</i>	Stephen	Dev	Rachel
Location	California	Scotland	South East England	North West England
Followers/ following	589 / 1118 <i>(236/516)</i>	497 / 1282	2849 / 3245	1948 / 3612
School type (age range)	Mixed American public high school (14-18) approx. 2700 students	Coeducational Independent Secondary School (3-18) approx. 1600 students	Mixed State Secondary school (11-18) student number unknown	Mixed State Secondary School (11-16) student number unknown
Subjects taught	Advanced Placement (Calculus) Physics	Physics – higher and standard grade	GCSE Physics and Maths A level Physics and Maths	GCSE Chemistry
Teaching experience	12 years however, in the first year of teaching AP Physics	20+ years – also Head of Physics Department	5 years	10 years

	<b>Beth under her own name</b>  <i>(Beth under a pseudonym)</i>	<b>Stephen</b>	<b>Dev</b>	<b>Rachel</b>
<b>Additional information</b>	Active in National Subject Association, works with local museum to provide support for new teachers. Works part time rather than full time. Runs two accounts – one publicly linked to her name and one which is anonymous with no personal information. Issues surrounding funding for resources. Has no resources for AP so Beth is starting teaching this course from scratch with classes of 30+. High pressure environment with students applying to Ivy League universities.	Senior member of subject society in Scotland. Also works closely with colleagues in the subject associations in England. Attends subject association conferences both north and south of the border. Delivers CPD to other teachers both in Scotland and in Canada. Completing a master's degree. Twitter handle is his own first name.	Deep interest in assessment including psychometrics. Has been part of blogging and development of a group focused upon the use of cognitive science in science education. Dev attended this school as a student. Attends weekend CPD to support his own and others professional development. Twitter handle is his own first name. Ethnic minority background	Attending weekend CPD in order to support her plans to move across from secondary to primary teaching. This CPD is focused upon developing primary pedagogy rather than science specific. Is a trained biology teacher rather than Chemistry. Department staffing is unstable with several temporary staff and staff who were leaving. Twitter handle is a nickname but linked to her own first name.

## 4.1 Case Studies

### 4.1.1 Case Study 1 – Beth

Beth teaches High School Regular Physics in Northern California. The area is affluent, with students aspiring to go to highly competitive colleges. After 12 years of teaching the regular physics courses, she was asked to teach an Advanced Placement (AP) physics course for the first time in 2017-18. She expressed reluctance to do this but with no one else available, she agreed. Beth did access some training for the AP physics course prior to the start of the year. The AP Physics

course is a college level course that requires students to use calculus and contains two elements – Mechanics and Electricity & Magnetism. Despite the part-time nature of her post, she has 3 classes of AP physics each having over 30 students and each placing a real demand on her time as she is often planning lessons from scratch.

Funding pressures also affect Beth as she describes having to write bids for grants, recycle equipment and even accepting a donation from a former student for licenses for computers as she cannot afford to buy lots of new equipment and therefore hangs onto old equipment to use. The pressures on her students to achieve exceptional grades to gain entry to places such as Harvard impacts Beth in the classroom. In Beth's opinion, they take courses they are not ready for, cheat in tests and do not have the time to do the course well.

Outside of the high school, Beth is an active member of her local branch of the National Subject Association and has links with a large science museum that offers professional development for science teachers. Through this she has accessed both support for herself and has worked with newly qualified physics teachers to support their early career development.

The research begins during the second half of Beth's first year teaching AP Physics Course. She had completed Mechanics and was then teaching Electricity & Magnetism.

At this point Beth has significant professional development needs. Teaching a new course means that she has few resources. She is unable to get support from her current school as no-one has taught the course. She needs not only to create, borrow or acquire resources, but to gain a full understanding of both what content she needs to teach as well as the pedagogical approaches required. In addition, Beth must carry out practical work with students with limited resources and so needs input on practical physics as well as theoretical aspects.

#### 4.1.2 Case Study 2 – Stephen

As Head of his science subject in an independent school in Scotland, Stephen operates in a different education system from England. While he has links across the border, it is in Scotland that he is deeply involved in Science Education. His department of 7 staff teach in the secondary phase of a 3-18 school. Stephen is involved in a senior position in a Subject Society in Scotland and serves on the Education Committee that has input into the curriculum decisions at policy level as well as building links with other societies in England. While accessing individuals on Twitter he both sees common issues that affect Scotland as well as England and the very distinct issues that are more prevalent in either nation.

Stephen's involvement outside of teaching includes organising the visits of international scientists to deliver projects, delivering training to Scottish science teachers, and even travelling to Canada to be involved in Summer School activities for teachers there.

During the research Stephen was also completing his Masters Degree looking at professional development of teachers and how to improve it.

While Stephen himself is located remotely from major population centres, he is working with others who are even more geographically isolated from professional development opportunities than most.

#### 4.1.3 Case Study 3 – Dev

As a teacher in his third school and having only 5 years' experience, Dev is teaching both mathematics and science in a department with 10 staff in a large city. He went to the school as a student before coming back as a teacher. Dev joined Twitter during his training year and has been using it ever since. As a recent entrant to the profession, he is still developing his practice in the classroom and is involved in several professional development activities. He has a focus on both assessment and evidenced based research in teaching. This has included him organising and

attending events at the weekends to support the professional development of himself and others.

#### 4.1.4 Case Study 4 – Rachel

Rachel is a science teacher in a school in the north of England. A biologist teaching Chemistry in a secondary school, she plans to move across sectors and become a primary teacher. Much of her efforts involve developing the skills and knowledge of the primary school curriculum and teaching to help her transition across and gain a post in a primary school. She takes up many opportunities to engage with others both via Twitter but also in Twitter organised events.

She is not only willing to attend weekend CPD but tries many new things from Twitter in her classroom. Rachel states 'I want to be in a school that appreciates me'. During the research, Rachel successfully gains a post in a primary school partly through the links developed via Twitter.

Having discussed my participants, I will now analysis the data in relation to each research question.

## 4.2 Research Question 1 – How do individuals build a network to facilitate information literacy using Twitter?

### 4.2.1 Joining Twitter

Each of the participants talk about finding value in the joining Twitter however they used it. This meant that they maintained their use of Twitter rather than drifting away. There is often a motivation to seek information that comes from the person and their specific context that drives them to identify more sources of information, of which Twitter is one.

For each participant, it is another person who has introduced them to Twitter specifically, a more experienced user brings in the novice user. Their observation of the practice of this colleague/peer leads them to consider this practice relevant; they find this person credible. In all, its use by someone else pulls them towards the tool.

For Beth,

*'I went to the National Meeting but in the winter, which is smaller and it was the first time I'd ever been and I would meet people and they would go 'oh, What's your twitter handle?' And I'd go I don't have one so I made one right there.'*

Beth's peers have adopted the practice of engaging by Twitter to communicate and this supports her own choice to adopt this new practice. This adoption then allows her to maintain the links and build trust with individuals with whom she may have had only a brief initial chance to communicate face-to-face.

For Dev, there was encouragement from an individual who was in a supportive role to enable him to build not only his social capital, but also his decisional and human capital. The AST (Advanced Skills Teacher) who had encouraged him said.

*'first year, ZZ AST at the same school and Twitter is interesting and cool.'*

Dev then followed up by introducing others who were on his training course

*'Got into it PGCE year - made a guide on how to use Twitter for other students - all give one thing to share with group in second placement'.*

For both Dev and Beth, the use of the tool by their peers or someone in a position of trust provided motivation for them to use it. Dev then extends this to his fellow students using the trust he has built up during his PGCE. Trust, and credibility of those who introduce it, can overcome initial reluctance to adopt the tool.

For two participants, it was the second social media platform that they had tried to connect with other teachers on. Both Stephen and Rachel had also used Facebook. The lack of interaction or benefit meant that they did not maintain that use, particularly after finding Twitter. Stephen described the reason why he preferred Twitter,

*'I joined Facebook groups but not much traffic, only handful of people and not meaningful. Twitter - more immediate in getting a news feed'*

The decision for the participants to join Twitter is embedded in recommendations from others combined with a clear and quick return on the time investment in using it.

This is an interesting contrast between two social media platforms and their perceived usefulness to teachers. The importance of 'traffic' flow – new and novel information is an important factor for individuals who are using it. Too little and participants do not get a return on their investment but there is no mention of too much. Participants want a return on the time invested in using Twitter. This indicates that Twitter is an important aspect of the participants' information landscape.

However, Rachel brings up another aspect when she describes Facebook as 'cut-throat' and she describes individuals can be removed from the group if they offend. This brings into focus the aspect of gate keeping in groups and communities. Facebook pages requires an individual to allow other individuals to access the content, and to monitor and restrict users, whereas Twitter does not have this role. This removal in a Facebook group would cut off an individual's access to information from others. Twitter itself can do this because of a complaint procedure. For individuals, the only way to do this on Twitter is if an individual is blocked by another user. This might remove one voice from the information landscape, but does not necessarily remove them totally from the landscape.



Rachel's assessment of the value of this shows how she distinguishes between the two platforms and their structural dimensions as described by Nahapiet and Ghoshal's model (1998). The affordances influence the choice of platform. Twitter, being a less bounded community without the same 'restrictions' on access, allows more individuals to voice their opinions without the same risk of being completely removed from the group when breaking the norms. This is particularly important for Rachel who describes a lack of social capital in her current workplace as she said *'I want to be somewhere that appreciates me'*.

All the experiences of the participants indicate that they are engaged in information literacy activities within their practices – searching for new sites and sources of information and as a result they are referred to Twitter by an experienced person who undertakes both influence and information work to support them in engaging with the community.

#### **4.2.2 Building a Profile**

Every Twitter user has a profile with their name, picture, a short biography, perhaps a link to their blog, a location, and the date that the individual set up the account. This is in addition to their 'Twitter handle' or username that begins with @. Three participants had a profile that was linked to their real name and contained a photo of themselves, rather than another image. The final one, Beth, had this on her named account, but none of these details on her anonymous account. This is an active choice of the individuals when creating a profile but if users choose not to upload an image, Twitter simply includes a picture of an egg. Each participant's profile contains the date they joined and the information they choose to share in the network. All the participants included their status as a teacher of science indicating that they are linking to others professionally rather than just for personal reasons. The choice of including the geographical location showed more variation from Stephen, who does not include this information, to Rachel who provides a small-town location. Beth, who is in the USA gives her geographical location as the state, however, she is the only participant to actually name her school on the

profile. This allows others to directly link her to a physical location however, Beth does this only on her 'named account' not on her anonymous account. This variation may relate to how individuals are managing the risks involved in Twitter, by limiting the ability for others to physically track or link them to specific organisations.

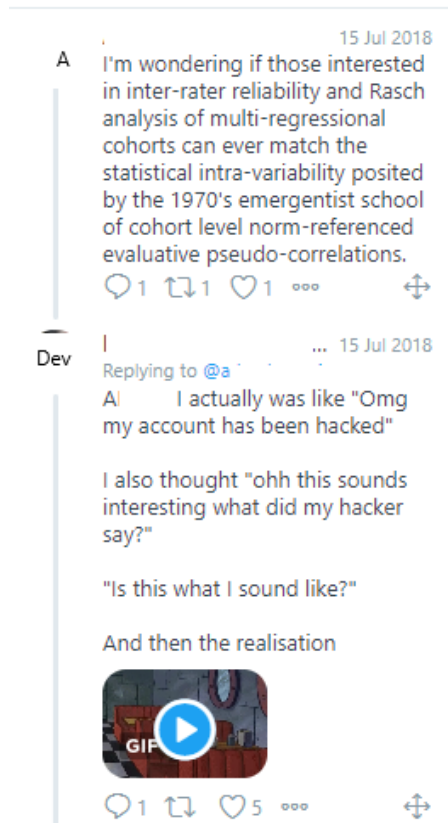
An individual's identity is tied to the choice of handle and this becomes as important as their real name; Dev illuminates the importance of this when talking about an individual who does not use her real name

*'When meet up and talk - we call her by her twitter handle rather than her name. Want to hold onto the Twitter handle; her name is actually XX. Pseudonym and handle become so important - after conference - you talk about their handles on twitter, just using them, but using real first names.'*

The individual concerned initially had a pseudonym as both name and twitter handle, however, this has changed. While the twitter handle remains the initial pseudonym, she has changed the 'name' on the account to her real name.

This indicates how much of a person's identity for others can be tied up in the name that they choose and if this not their 'real name' that the Twitter handle becomes their common identifier to others. However, these can be changed if the person chooses and this may create issues in identification by others. This aspect is also important when discussing the role of anonymous accounts and the element of trust. The importance of your image and handle to your identity was illustrated by Dev and a friend of his "P". "P" changed his own profile picture and name to the same as Dev and then tweeted a comment that was similar to something Dev would tweet. Dev mistook P's tweet for his own and could not remember what he had tweeted before he realised what P had done. (See Figure 4-1)

Figure 4-1: Example of Identity on Twitter



The issue of identity is closely related to the individual Twitter handle that the person chooses. As Dev remarks - people recognise the name and not the faces, as many often do not have pictures. He also noted that putting a picture of himself led to an increase in followers, but that this profile raising did make him feel uncomfortable. While not wanting to be anonymous, he is uncomfortable with linking a photograph to his account, but this is also linked to his increasing contributions,

*'realise that people who are worlds apart in intellect and academic circles recognise me and my contributions. It is very strange, I'm getting more and more, people know you. [I] feel uncomfortable putting myself out there'*

While Dev did not elaborate, the increasing visibility of his profile linked with the photograph may be exposing him to more individuals who recognise him at events such as conferences, even if they have not met before, this may be leaving him

feeling somewhat exposed. The increased visibility and possible increase in his credibility with the photograph is allowing individuals to identify him more readily as a credible source of information.

Rachel had a twitter handle that she was advised by one individual to change if she was using Twitter for job hunting, indicating how others may perceive her based on this. Rachel stated *'I didn't change it'* as she did not feel that this would be a deciding factor in offering her a job.

Figure 4-2: Beth's Real Name Account



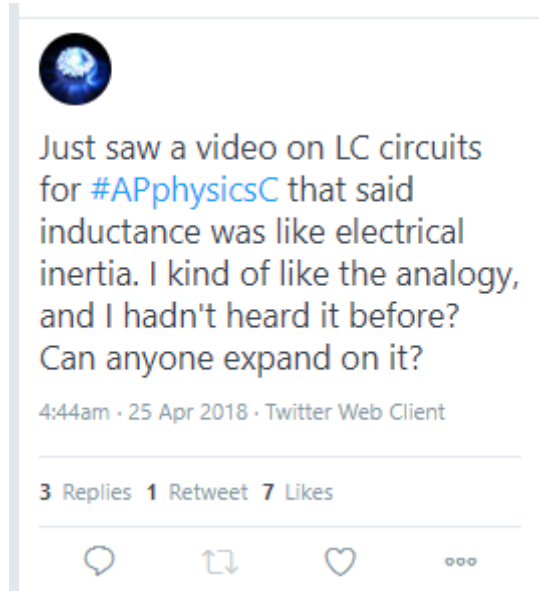
Figure 4-3: Beth's Anonymous Account



While many people choose to use real names or link to organisations such as their schools, others choose to remain anonymous. Beth maintains two accounts; the first one she set up with her real name and the biography indicates both her job title, her school and her role in her local subject networks (Figure 4-2). Her second is an anonymous account – the username indicates that she is a physicist and a parent teaching AP physics (Figure 4-3). However, it has no photograph of herself, instead a selected image is used. The location of both accounts is the state in which she lives is the only common detail. Of my participants, only Beth operated a second anonymous account under a pseudonym. She described using this for asking questions and interactions that she did not want her students to see such as answers or silly things that students had done. For example, (Figure 4-4) where

Beth is asking for help in an aspect of pedagogical content knowledge which she is unfamiliar with.

Figure 4-4: Asking for help



This is another example of how using the affordances of Twitter, Beth is navigating the information landscape and carrying out information and influence work. She carries this out under her anonymous account to ensure that others do not discover this.

Towards the end of the data collection, Beth said that this account had been found and linked to her by the students. This had been revealed to her by the principal of her school who had been approached by students complaining about their work being posted on her Twitter feed with the comments that they were unhappy with.

Beth tried damage limitation, deleting many tweets that she felt may have been the cause of the complaint, changing the Twitter handle and locking access. She lamented the loss of this account and the ability to access her peers as well as the real issue of how social media mistakes can cost careers.

*'Annoyed that I've lost that ability to ask questions of my peers. Now feel I can't ask these in case students following me on it.'*

This loss of anonymity and the linking of her to the account meant that Beth was more suspicious of who was following her account and she changed the settings on the account to private. This change meant that only her followers could see what she had tweeted, but she still went over her followers to see if there was anyone who may have been a student and removed any who she felt may not be trusted.

As a result of this Beth has lost access to a part of her information landscape due to risks on her professional credibility and this has a profound impact on her. By changing the settings and locking the account she restricted her access to others and vice versa.

The issue of teacher use of social media and its risks means that many choose to use pseudonyms to protect their identity. Beth stated that she noticed a lot of individuals who do not have their names attached to their accounts because of the risks associated with this.

*'I notice a lot of people don't because they have it with their name. ZZZ a college professor, he doesn't have name because he has had issues with his dept chair and there is another one, @MsPhysicsteacher who is also anonymous - she complains more and is more frustrated'*

This is a common issue in UK teacher education and the implications on teachers and their careers may ensure that teachers are more cautious about what they will post in public as illustrated by the range of guidance offered by organisations such as the teaching unions (NEU website 2019).

All these aspects of Twitter relate to the identity of a person and how they choose to develop and present a persona to others. The profile and other aspects embedded in it allow others to identify if the person is likely to be a source of credible information that they can use. Individuals are constructing their identity

from the moment they start to use the affordances, making decisions on what information they wish to present or keep private as they explore the platform and what it can do for them. These can change over time depending on their experiences, the trust built between individuals and as they learn to construct their network and identify the groups with which they interact.

#### 4.2.3 Network ties

If we look again (See table 4-1 at the beginning of this chapter) at the numbers of people who each participant follows, we can immediately gain an idea of the scale of the network each participant has created through their use of the platform and the configuration of tools.

If we observe the number of followers for each participant, two out of four participants have a network that is around 500 people (Beth and Stephen). While the size may limit the density, what is not seen in this is the strength of those ties i.e. which ties are much stronger than others. When this was discussed with the individuals, they identified three main groups who they followed.

##### 4.2.3.1 Experts

Firstly, those who are considered international experts in their field such as Professor Dylan Wiliam or Professor Andy Hargreaves. According to participants, these do not have close personal ties to individual followers, but their level of expertise leads them to have high levels of credibility within the network.

Participants engage with the experts Twitter account to access information that they anticipate will be of high value for them. Stephen describes observing discussions between experts as following researchers such as Dr Aileen Kennedy and Dr Carol Campbell who are academics involved in an area of research in which Stephen was completing his Masters' degree. He is gaining access to some key experts who are in a different community of practice but by using Twitter he gains insight into the social and epistemic knowledge base. Both Dev and Stephen, comment that Professor Dylan Wiliam is a high value individual who they follow. As

an internationally leading academic, both participants like the ability to gain access to the social and particularly the epistemic knowledge of Professor Wiliam easily and quickly if he chooses to share it with his followers on Twitter. Nahapiet and Ghoshal's (1998) model aspect of structural configuration of Twitter allows individuals to follow such people and create network ties, and facilitates a path to access information that previously would have been more difficult to obtain for example, access to papers that would ordinarily be behind paywalls or conference proceedings. This increased availability and the high regard in which Dev and Stephen hold this expert highlight both the anticipation of value and motivation to combine knowledge in this interaction. This will be returned to when we look at how they use the tools of Twitter for combination and exchange later.

This type of relationship is likely to be one way – from expert to individuals. Professor Wiliam follows only 65 people but not Dev or Stephen. Professor Wiliam is followed by over 87,000 individuals showing that for the most part, information flows outwards. However, Dev describes how this network tie and configuration has led to a two-way interaction with Professor Wiliam. Dev's involvement in the community of practice surrounded the role of assessment and the production of a series of blog posts shared via Twitter. These posts linked to the work of Professor Wiliam. Dev had the opportunity to ask Professor Wiliam a question at a conference. Professor Wiliam knew who he was and said he was looking forward to reading Dev's blog post on the topic. The configuration of the network means that Dev is engaged in the discussions around practice in a community with the same core group of individuals, but that experts can also choose to engage with those discussions, perhaps on the periphery or even just lurking. The community discussion around the practice has allowed experts and classroom teachers to enact all aspects of information literacy allowing both to see further across the information landscape.



#### 4.2.3.2 Similar Practices

The second group are those that are involved in similar practice such as teaching the same course or interested in the same aspect of practice. These are professional relationships. For example, Beth describes several individuals who she has both online and offline ties to due to her work in the subject association, and these may also fall into this category. This is where the importance of the profile is seen again – when building a configuration that meets the needs of the individuals to support building their capital, profile is one aspect of the individual that is judged. For example, Beth describes what she is looking for when she is building her network configuration.

*‘there’s been people would help me in the fall and now, it’s like looking for more people with the Electricity and Magnetism and find that the collegiate people actually respond a lot more’.*

Beth’s main aim is to access the human capital of those who teach the same course as she does – those that either have a shared context or a similar one. This is another enactment of information literacy, influence and information work as well as entwining as she is developing an awareness of where the information is situated and how to access it. This work then allows her to access the higher human capital of those who work in colleges to help her develop her own human capital, in this case, the depth of knowledge of physics.

#### 4.2.3.3 Personal Relationships

The final group are individuals who the participants have a personal and often face to face relationship with that demonstrates strong ties. These can be people who they know came to know through their interactions on Twitter or face to face through professional and/or personal relationships. This is an aspect of the Nahapiet and Ghoshal’s structural dimension of appropriate organisation, whereby social capital that has been formed in one setting is then transferred into another. Beth, Stephen and Dev all indicated individuals who they have professional

relationships with, but these ties are likely stronger than most, as outlined by Dev, who describes a trio of individuals as people who 'get me'. It is these individuals with whom he has built a community of practice around cognitive science in education. The extended interaction between them has built trust and strong ties. While these ties may have formed on Twitter, the movement to face to face strengthens the trust between them. Rachel describes attending 'BrewED' meeting to talk about education and then attending a conference in North East England where she met individuals who she had known only via Twitter. Having built the social capital, the affordances are allowing individuals to enact information literacy across geographical boundaries.

#### 4.2.4 Finding and Following People

A feature of Twitter is that individuals choose who they follow and therefore whose tweets and retweets appear in their timeline. Dev and Stephen both describe the timeline as a 'newsfeed' constructed by their own decisions and choices of which other Twitter accounts to follow. These accounts may belong to individuals who are within their own community of practice or school; for example, Beth describes one individual who helped her early in the academic year teaching one aspect.

*'[named person] is really good, he's one that I know locally as well. He runs our physics support program but he only does mechanics, so there's been people who would help me in the fall and now, it's like looking for more people with the E and M [electricity and magnetism] and find that the collegiate people actually respond a lot more'*

Yet, the choice that is made can also help the teachers use Twitter to cross boundaries into other communities of practice and allows users to bring high profile individuals into their network. An example of this is Professor Dylan Wiliam, who is followed by over eighty thousand people. Two of the participants rated him as one of their top three people in their network indicating how much they value what he tweets and the ability to connect to him using the affordances of Twitter.

Teachers can make choices about who to follow with reference to instrumental professional or career goals. For Rachel, who she follows is related to her desire to move across age phases from secondary teaching to primary teaching. As this is her aim, she chooses people who are involved in the primary sector to follow and ask advice from. Given the timings of the day, it is difficult for Rachel to meet those involved in this aspect of education physically, so Twitter facilitates interaction. Similarly, Beth is continually building her network, finding more people who can help and in places such as college level educators who perhaps she would not normally meet during her usual activities. Both are using Twitter to access the knowledge and understanding of others to support them in achieving their current aims.

Stephen describes his ability to engage with both researchers and policy makers including Members of the Scottish Parliament involved with high level education policy.

*'Ian Gray - shadow education minister for Scotland - on a train going to a meeting about teacher education. He was tweeting about what was going on in parliament.... communication directly with person'*

For Dev, his relationship with an academic organisation provides additional benefits,

*'Cambridge Assessment Group, they're brilliant people and every single time they have a live sessions, a Twitter live seminar they DM before and ask do you want pizza and sends pizza to my school and then I tweet and people are like where did you get the pizza from 'Cambridge Assessment sent me some pizza'*

Dev's description of his relationship with the individuals who run the Cambridge Assessment Group also shows that behind a tweet can be a professional relationship that has started on Twitter, but then extends into deeper personal relationships for some individuals. This is a common theme among the participants.

They talk about individuals who they have got to know through Twitter and their shared interest in teaching. Many contacts initially made on Twitter then become face to face interactions for all the participants, regardless of their location. Dev and Rachel describe how relationships built in Twitter have moved to becoming a face to face relationship where they have met individuals in person. Stephen and Beth have met individuals who they know from Twitter when attending subject association conferences. The relationships individuals develop are facilitated and maintained by Twitter.

Who to follow often involves people who are interested in the same things such as education, but it is not without an awareness of creating their own 'filter bubble' (Pariser 2012) as Stephen describes,

*'Twitter...can form its own little bubble because you select who you listen to but as long as you listen, aware of that, you can follow who you want to hear or value their thoughts and opinions'*

This raises the issue of selection of those who agree with us and the creation of our own echo chamber of people with similar views. Stephen is aware of this and Dev has individuals who he follows and challenges when he does not agree with their viewpoint. Yet at the same time Dev has conversations with those on Twitter that indicate that groups of those with minority interests often find those with similar interests.

*'I know that the people in that tweet thread all very nerdy, I wouldn't have this conversation with other people'*

Geographical distance can be a barrier for many organisations and groups. However, Twitter allows participants to follow and interact with those from a wider area. Stephen has formed links with individuals at a high level in the subject association that is cross-border, that gives him a 'broader perspective in England'.

All these aspects highlight the enactment of information literacy – by choosing the people they follow, individuals engage in information sharing and this in turn affects the information and influence work.

#### 4.2.5 Conflict – Block, Mute and Tweet

Finding and following people does not just involve selecting people to follow but making the judgements to reject individuals – choosing not to listen to them. This can be as simple as ignoring tweets that the participant is not interested in, for example, about football, or as radical as blocking individuals.

*I blocked more this year alone, than since started in 4 years.*

Dev noted that the atmosphere has changed over time, and this has led to an increased use of the blocking tool. This ‘blocking’ means that the blocked person cannot see a user’s tweets, followers lists and cannot direct message them. They are effectively removing the other person from their network. Dev describes how he becomes physically agitated and gets angry at some of those things he sees and that the ability to block removes these issues.

Rachel describes Twitter as ‘tribal’ and that she has received private direct messages warning her of getting involved in disagreements. This is not unique to Twitter as she describes similar experiences on Facebook which is considered ‘more cut throat’ as users can be thrown out of a group and isolated with no access to other users who remain in the group. You cannot be removed from the whole collective group in Twitter, only remove someone or someone removes you from their network by blocking. Only the stewards of the Twitter platform can cut any individual out completely. Even unfollowing removes someone from their network – but still allows access to the remaining individuals.

Another tool to control and filter who and what a user sees is the mute button. This stops notifications of tweets from an individual without blocking them, so they can still see their tweets, but they do not appear in the user’s timeline. This is less harsh than blocking as muted individuals can still be retweeted into a person’s timeline.

Conflict can arise on Twitter and sometimes this is through deliberate provocation, through being economic with the truth or through manipulation of events.

Dev describes one instance where he felt someone was trying to stir up conflict and selectively presented information and his response. He describes how this individual was tweeting provocative comments and his response to those tweets was to challenge the person, including through private messaging.

Dev is clear that not only was this deliberate 'misinformation' but that this was designed to set up and cause a disagreement.

*'Know was intentional - he knew it was going to be rejected ..... stirring up trouble - and in all public and private - intentionally provocative and controversial and get rejected.'*

Individuals can be selective with Twitter to present what they want others to see rather than the complete picture.

*'He didn't publish [named person's] peer review but we know because Dylan tweeted it. He hasn't included the selectively selected the peer reviews to fit his world view.'*

While many people regard Twitter as a positive and useful tool, this illuminates the less than positive aspect of its use. Misinformation produced by one, was refuted with evidence from another. The individual refuting this was Professor Dylan Wiliam according to Dev. Perhaps Professor Wiliam's position in education meant that it was easier for him to challenge others than for someone who is less highly regarded.

Dev also then decided to retweet many tweets both to annoy that person seen as either spamming or petty behaviour but also by retweeting a particular organisation often. This increases the account's engagement statistics for the 'social media manager' at the other end. It is Dev's way of saying – I support them.

The ability of people to see, capture and store tweets means that any change of position or hypocrisy is much more visible, rather than relying on the memory of 'he said, she said'. This can then be challenged by others leading to conflict or accusations of deliberately manipulating information – an aspect of information literacy as tweets can become permanent records. Conflict then arises out of this – affecting the social capital elements of trust and obligations.

The battleground of what constitutes competence in teaching practice is front and centre of the debates and conflicts arising using Twitter, often with the 'progressive vs traditional' teaching approaches that dominate the Twitter feeds of UK participants. This is one of those debates that is ignored by Stephen who states that he will unfollow someone if he does not find useful or whose tweets are objectionable. However, even in the middle of a potential conflict, individuals can direct message and reassure the other person that the challenge is meant as discussion rather than aggression as Dev did.

In engaging with a community conflict arises, as the discussion around what information is provided and in what modality as well what information is valued. This is another example of information literacy practice in action.

### **4.3 Research Question 2: How do teachers the affordances of Twitter to increase their professional capital?**

The huge volume of information that flows through the network requires the individual to carry out information literacy activities to filter, extract, store, and share information. In order to do this, individuals have to develop their digital literacy – the ability to use the affordances of Twitter to carry this out. This section outlines how different Twitter affordances are used by the participants as they enact their information literacy practice.

#### 4.3.1 Information literacy practice - Sharing information

As Lloyd (2010) states, information sharing is one aspect of how information literacy is enacted. Much has been made of the use of Twitter to provide resources and ideas for teachers, but the picture is more complex as individuals must filter what is useful from the irrelevant. For example, Beth describes how she decides if she is going to use something,

*[FN] - offers a lot of stuff, offers background information. Someone offers something – that’s great, how do you do it, and they are like - I will have to find the paper, I learned this way back or something. He will often provide a lot. He is good. He gives the completeness of what they share which is often the deciding factor. If it’s something I can use vs that’s cool, someday I will figure it out.*

In this Beth describes the completeness of the resource – the artefact. The artefact is an example of epistemic information and allows her to get the information with little dialogue and embed it into knowledge. The ‘resource’ becomes the mode of transmission from Frank to Beth (Whitworth 2014).

This is shown in Figure 4-5 where Beth has a discussion with the individual to clarify her understanding of a particular practical.

Figure 4-5: Clarifying understanding





There is a trust element that has been built up over interactions, whereby Beth feels able to ask further questions of FN and he is willing to respond and share his knowledge to support Beth. FN's credibility has been built over time – both via Twitter and via personal offline interactions. The ability of Beth to ask a series of questions means not only is there trust but that she values the information without needing further verification from others. This is an example of Beth entwining knowledge, both having located, accessed it and then with an expert engaging in information work to reproduce the knowledge. This also shows the influence work of FN with Beth to engage epistemic and social knowledge. Epistemic knowledge of capacitors and science, the social knowledge – knowing how to do the practical.

There is a filtering element going on with the selection of what is useful. For Beth, her criteria are not only should something useful for her but the completeness of the instructions they share should make it viable to use. FN provides her with detailed instructions on how to carry out a practical lab with her students and is willing to answer her remaining questions. However, Beth makes it clear that this is not always so. So, while many teachers share 'stuff', the uptake of the information can be influenced by the ability of the person to 'use' it or integrate it into their existing knowledge or practice – their combination capability or their ability to

entwine the knowledge. Also, by the constraints of the affordances and the site in which the information literacy is happening. Trust is often built by supporting others to integrate new practice into their existing practice as individuals see the benefits. This is both influence and information work in practice.

For Rachel, she had seen something that was a new and innovative practice for her that she wanted to try out in her school, but her context presented a problem in implementation,

*'A year 11 revision buffet retweet it sounds good and liked the look of the revision quilt [both different practical activities for revision]. I like that they colour in specific phrases for specific topics for lower ability helping make it stick a bit more. It needs a lot of photocopying but I'm not allowed to do that much.'*

The 'revision buffet' and 'revision quilt' are two innovative practices that require students to have lots of different sheets to use to build their knowledge. The limitations of the site of her teaching practice mean that while Rachel would like to try the new idea in her classroom, the constraints mean that she cannot – in this case the cost of photocopying. Similarly, Beth also rejected a practice involving electronics because *'my electronics expertise is not that high so I can't do that and also the cost of it'* again indicating the site of the practice and financial restrictions in enacting this aspect of practice. The site (Twitter) in which the knowledge is found does not restrict the new teaching practice, it enables its sharing; but the site of enacting that knowledge, that is, the teaching practice, does restrict it. This then is constraining the sharing of information that can be turned into knowledge by some individuals but not others – while some individuals may be able to overcome these or carry them out under the radar of the community, for some the new site constrains the use of the knowledge in order to improve practice.

This demonstrates from the participants an awareness of what is possible in their own specific teaching practice site – their classroom; the knowledge and practice is

not simply transplanted from Twitter to the classroom. Both sites impact on the information literacy practices engaged in. Every image, discussion and reflection are always considered within the context of the potential new user's site of practice.

There are aspects which may restrict individuals from sharing information on Twitter. The Times Educational Supplement website provided a platform for teachers to upload resources to, to share with other teachers. In the past couple of years, it has changed from a totally free service, to allowing individuals to charge for resources that they have uploaded, and there have been cases of individuals uploading and charging for other resources. Dev describes how this has influenced his decision to not share resources.

*'Reluctant to share other (Mastery) booklets. They can take it and put it up on TES and charge for it. I never meant to be charged and it's for everyone. ....I share more resources in the Cog Science group because of the feeling of who do I trust. There has been a sea change of TES charging that has affected this.'*

Dev is also reluctant to share most of his own resources because he cannot remember if it is his own resource or one that he has got from someone else. This is because the resource is *'so deeply embedded into my psyche it's mine.'* He does not want to share something without crediting the author. When he is unsure, he will not share. Again, there is an underlying element of trust – having been given something by someone else he does not want to destroy the trust by sharing something and claiming it as his own. The decision not to place resources on TES has been made considering that he has seen others break that trust or having their trust broken Dev stated. The unscrupulous use of epistemic modalities of information without credit is a norm for the community of teachers and leads to weakening of both strong and weak ties and to others restricting access to information to a smaller and smaller group of individuals who they trust.

Sometimes individuals simply share what they like in the hopes that someone will find it useful, for example Rachel shared her favourite practical and Stephen shares surveys for colleagues to increase participation.

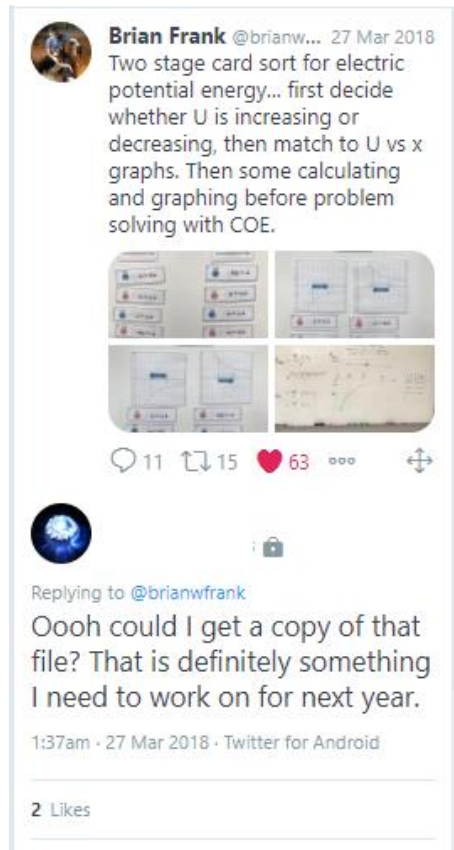
Figure 4-6: Sharing what you like



Sometimes a request may go out to another individual to ask for a resource to be shared, but this does not always happen. In the case of Beth, she made a request but did not receive the resource. This started a conversation about whether individuals should use someone else's resource or is it better to make their own. Just because individuals ask for resources does not always mean that they are handed over; it appears the stronger the relationship between individuals (the social capital aspect), the more likely this is to happen. The lack of social capital is

restricting to access to both epistemic and social modalities of information in some cases.

Figure 4-7: Sharing resources or not



For all participants, there needs to be trust and a sense of obligation for resources to be shared. That trust can be easily broken, making individuals more cautious about who they trust and what they share. Equally, just because someone shares resources via a post, does not mean that they are under any obligation to share it with others. Simply not responding to requests to send the resource can be a response of sorts. People who do not routinely share may then find that others will not oblige for them or that requests are not considered limiting their access to others, weakening ties, and restricting their ability to information and creation of new knowledge. This would be an example of the 'knowledge wilt[ing] away if it is never communicatively sustained' (Linell 2009, page 241).

### 4.3.2 Information literacy practices on Twitter

As the individual's network builds, there is an increase in the amount of information they encounter. Individuals use the affordances of Twitter develop some way of managing the information flow and their engagement with others – they enact information literacy practices. The choices they make here are also linked to what grabs the individual's attention and what resources they post that others engage with.

#### 4.3.2.1 Affordances of Twitter - Hashtags

Hashtags such as #ASEchat or #iteachphysics are commonly used on Twitter. The hashtag allows everyone to filter their feed to see the responses in real time. Dev describes his use of this:

*'Hooked up to Tweetdeck with column for ASE chat, UKEdChat, PhysEd, Following, hashtags, flicked through the hashtags on the way to work. Would use my commute time to flick through twitter. Every time found something interesting,'*

An example of this was retweeted by Beth in Figure 4-8 – the use of #iteachphysics means that individuals who use this hashtag can find the tweet by a simple search – linking tweets to interests easily and quickly.

Figure 4-8: Retweeting



Hashtags such as ASEchat and iteachphysics are used in weekly 'chats'. This was seen in the data of Stephen and Rachel. Beth describes one particular chat:

*'I like the 'iteachphysics' but depending on kids, I'm never available early enough to do it'*

Chats are time sensitive to be involved in and, for Beth, home responsibilities make it more difficult to engage at that time. However, the use of hashtags allows Beth to both find and manage information asynchronously as well as synchronously. For example, a newcomer could use a hashtag to find groups of physics teachers, as well as during a chat identify and filter information and to be included in the discussion. Figure 4-8 is an example of this.

This is different compared to the usual conversations that teachers would have in a staff room that are fleeting and only available to those that were there at that time. Any recall of what was discussed is not reliant on memory in these online chats making them more accessible to all, both building shared narratives, identification of those who can support and help and increase the chances of gaining access to parties for exchange and combination. These conversations are a more formal way of enacting information literacy on Twitter with the affordances making it easier to filter and extract useful information.

Beth also uses hashtags for 'teacherlife' tweets – aspects of her job that she wants to share with other teachers such as amusing answers from students and graph drawing issues. This use is less about finding aspects or following conversations and more about tagging tweets to share with others who are in the same profession. This is a distinctive use of social media by teachers – using it to share and build identity by sharing similar problems in our contexts.

Figure 4-9: Sharing common problems  
– Beth's Graph Fail

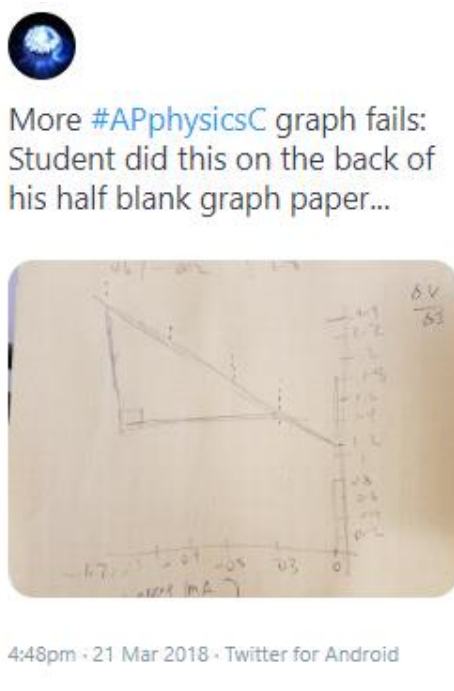
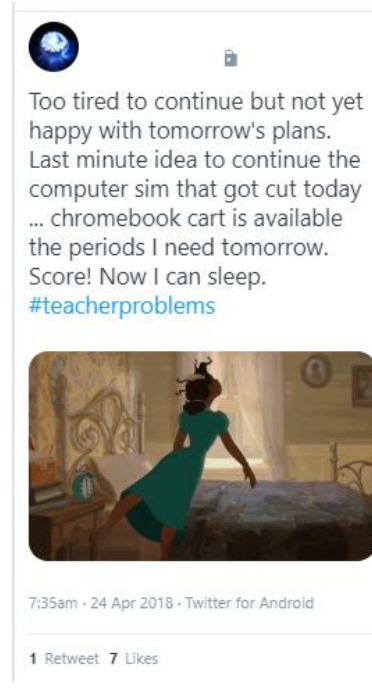


Figure 4-10: Sharing identity



The distinctive use of this tool to build teacher identity and bond them together across schools and contexts has a far wider reach. Any science teacher across the world would feel Beth's frustration at the poor graph work (Figure 4-9) or the exhaustion of planning (Figure 4-10). Sharing this common problem builds the shared narratives and understandings in the network, increasing the chances of exchange and combination to create new knowledge as well as an important aspect of information work.



#### 4.3.2.2 Affordances of Twitter - Images in tweets

With a large information flow, some aspects get more attention or are more likely to be noticed than others. Dev notes that a cartoon about teacher life got many more 'likes' compared to the sharing of a resource or something similar. Images have a bigger digital footprint on the timeline so that may increase the chances of being seen and read. Dev actually stated that it was an image of glow sticks in hot and cold water that he had noticed and then carried it out in the classroom, and even reasoned that *'they see the pic as its bigger pixel footprint than text and get bigger likes'*. Beth describes how an image triggered her recall of something she had seen in training and had forgotten, and another image had been of a slight modification of a practical that she had already done.

*And [named person] is another one ... she had a very cool variation where she used an LED to show the discharge. And 'oh see how its working' - 'oh that I'm going have to try next year'*

The ability to entwine the limited information into their practice has enabled them to act in new ways, or trigger the recall of existing tacit knowledge.

Short video clips relevant to aspects of physics are often tweeted or retweeted. Beth describes both a Twitter account that provides a large number of videos she can use but then she also uses an additional affordance of an 'app' on her phone to download and save the videos for use later. This is an example of an additional digital affordance outside Twitter being used for information literacy activities. The extraction and storage of images and video clips particularly for use in the classroom is often cited as an important aspect of the participant's information literacy practice particularly if the topic is not due to be taught at that time. This relates to the ability to organise, store and extract information at the most relevant time for it to be integrated into their practice in the classroom.

Stephen had been set a challenge by another individual on Twitter to post pictures without comments relating to himself. These types of activities are common when

individuals are 'mentioned' and challenged to do something by someone else and then they 'mention' the next person to do the challenge. This interesting challenge not only produced personal pictures but the image below.

Figure 4-11: Stephen's challenge



Unless a user had met Stephen and attended one of his workshops the content of the tweet may have remained confusing. For those that had, they would recognise the experiment Stephen uses on a regular basis to demonstrate a physics concept. The whole image is tied up in a shared narrative and experience with those that had attended a specific element of Stephen's professional life and their own professional learning. The lack of comments in the tweet restricts others' ability make meaning out of the photograph and limits individuals' access to this knowledge without engaging in dialogue.

Images have multiple functions, from expressing emotions and frustrations, to demonstrating set ups and triggering memories of forgotten knowledge. They provide multiple ways of building both narratives, and network ties as well as providing new knowledge for individuals and overcoming the limitations of the affordances of Twitter such as the character limit.

#### 4.3.2.3 Affordances of Twitter - Likes / Bookmarks

For most of the time prior to the data collection element of the research, there was a 'like' button but there was not a 'bookmark' button.

Yet, despite the intended use of this affordance, many users did not use the tool for likings, but as a way of trying to 'store' tweets for retrieval later. Beth describes doing this particularly for things that she wants to use in the following academic year as they come up currently, for example, a video clip for motion and momentum, as seen in Figure 4-12.

Figure 4-12 Storing Tweets for Later



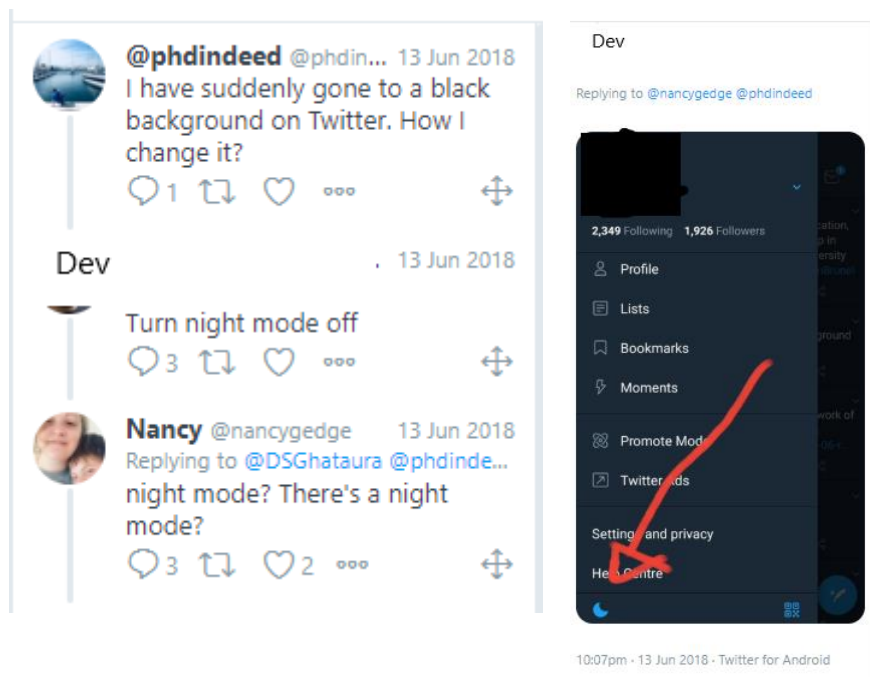
Twitter introduced a new affordance - the 'bookmark' in February 2018 around the start of data collection. The reasoning shows the development of the platform in response to users and their needs:

*'timelines are packed with Tweets that you don't always have time to fully explore in the moment. You told us you want to save them for later'* (Twitter 2018)

Dev pointed out in one interview he had *'Only just learnt how to bookmark this week,'* indicating that the uptake of the affordance is dependent on users finding it and learning to use it. This demonstrates his ability to adapt his information and digital literacy practices – choosing and using new affordances as they appear. This was not a vast change in the information literacy practices as many were using another affordance for this, however, it does demonstrate how users will make use of affordances to manage information in a different way than initially intended. He later shared that he had used the bookmark tool to save many research papers that he wanted to look at later. The tool was being used exactly as Twitter described and, in this case, it was to store and retrieve epistemic information.

The user posting the Tweet does not know if anyone has bookmarked it so an aspect of the interactions and their ability to see them is no longer there for the original user. This removes the visibility of the person using the resource and no longer links it to the presented persona. How this affects the individual's use of the platform is a new aspect which was beyond the scope of this study.

Figure 4-13: Getting help about night mode



Another aspect of digital literacy related to user's introduction and adoption of the bookmark affordance was Twitter's use of 'night mode'. The exchange above shows how changes in the technology can both confuse users who accidentally change something without realising, and then require a more digitally literate user to explain how to use the affordance. In this case, Dev uses both screen capture and an editing affordance that is not in Twitter before tweeting it back to someone to show how to change it back. Again, this shows influence work and information sharing as individuals help with developing the digital practice of the community, with the sharing of social modality of information.

#### 4.3.2.4 Affordances of Twitter - Retweets

What each individual retweets is totally up to them. For Stephen, some are useful little video clips, often funny, or in one particular case an April Fool's joke that linked closely to his work in bringing international scientists to deliver workshops in Scotland and this is something a user would only understand if they knew his involvement.

Figure 4-14: Retweet



*'Tunnocks [Scots biscuit firm] to sponsor NASA was an Aprils Fools, but given that involved in [details removed] and people know involvement I wanted to see if people think it's serious'.*

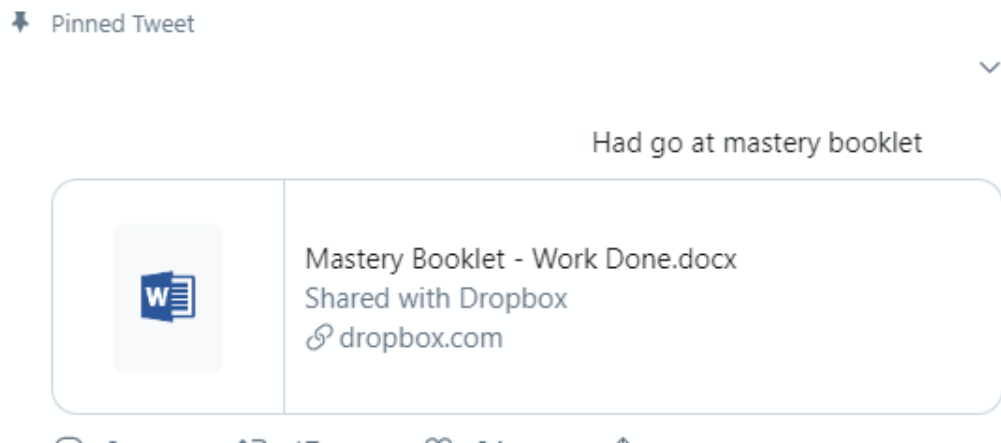
Individuals and organisations can ask for others to retweet them to raise the profile or reach more people. Stephen did this with a questionnaire that someone wanted more participants for. Rachel does this for a slightly different purpose; authors and companies often offer a chance of winning something to people if they retweet them. This promotion element is widely used, and for Rachel, this proved useful as she won reading books for her classroom library.

Often participants will simply retweet something that they find interesting or think is important to share and be seen by others, for example, mathematics textbooks or professional development. Retweeting is also quicker at events with Dev stating he retweets because he could not be bothered to type and wanted to talk to people. It is as if he is compiling his own highlights of the conference and what he feels are the most important points to share, while ensuring that he engages in face to face interactions rather than online ones – again – a teleoaffective structure (Schatzki 1996). While Stephen knows his re\weeting and liking can be *'random, there is no strategy for that'*.

For other participants much of the retweeting activity links to their activities such as blog posts, conferences, or promotion of events, that is discussed later in this chapter. The retweeting of information helps shape both how the information is shared, but also what is valued i.e. retweeted. The value may lie in the epistemic information or social.

A recent introduction of pinned tweets has again modified information literacy practices of two participants. Dev had pinned his mastery booklet for individuals to download, while Beth had a physics cartoon that she was regularly sent, but none of the participants commented on this tool, perhaps because of its relatively new introduction.

Figure 4-15: Example of a Pinned Post



Retweets are used for a range of purposes including efficiency, endorsement or to share emotion. All these are building shared narratives and language and strengthening the ties between individuals in the network as well as part of the information sharing activities. What an individual retweets is also often linked to their identity and persona in the same way that a tweet is.

#### 4.3.3 Affordances of Twitter - The character limit

Twitter initially had a character limit of 140 characters before increasing to 280 characters. This means that users must learn to express their views within this constraint of the site. Direct messaging was also subject to the same character limitations but during the research this had changed to allow unlimited character length in direct messages, thereby removing an existing constraint.

This is an aspect of Twitter that provides a constraining element to the information literacy practices. There are a range of ways that people work within the character limit or creatively overcome them by developing different practices. GIFs – animated images to express views or emotions particularly for frustrations. For longer passages from books – photographs are often taken or screen shots of documents and then attached to the tweet for others to read the full text, rather

than a summary produced by the user. Often the user is then just able to add a comment on the text. See Figure 4-16.

Figure 4-16: Comment on text images

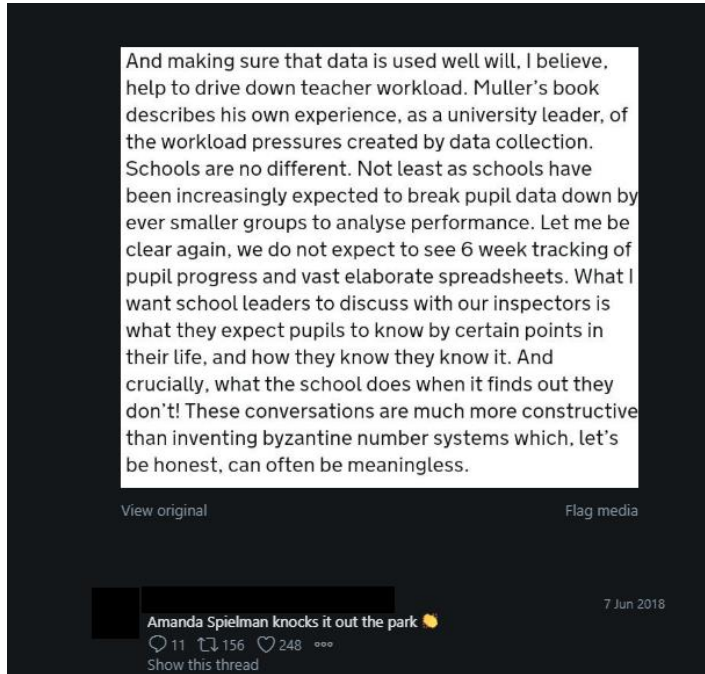
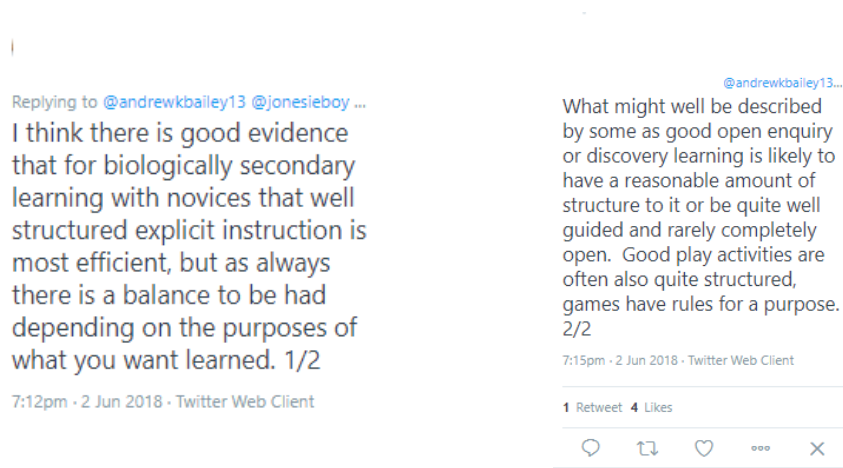


Figure 4-17: Multiple Tweets



Another strategy to avoid the limitations of the characters is multiple tweets one after another and often numbered as seen in Stephen's tweets (Figure 4-17). This



ensures readers can link tweets together to form a coherent narrative. The unlimited character of direct messaging may also allow users to switch to this mode to carry on an extensive conversation where there are only one or two individuals involved.

They also mean that individuals must have a good grasp of digital literacy to access affordances to create photographs, screen shots and links to share a wide range of epistemic and social knowledge. Often these affordances lay outside Twitter, on the devices on which they choose to access the platform. Each of these affordances lead to new information literacy activities and show development of artefacts in order to facilitate exchange and combination, dialogue and create new knowledge (Schatzki 1996; Nahapiet and Ghoshal 1998).

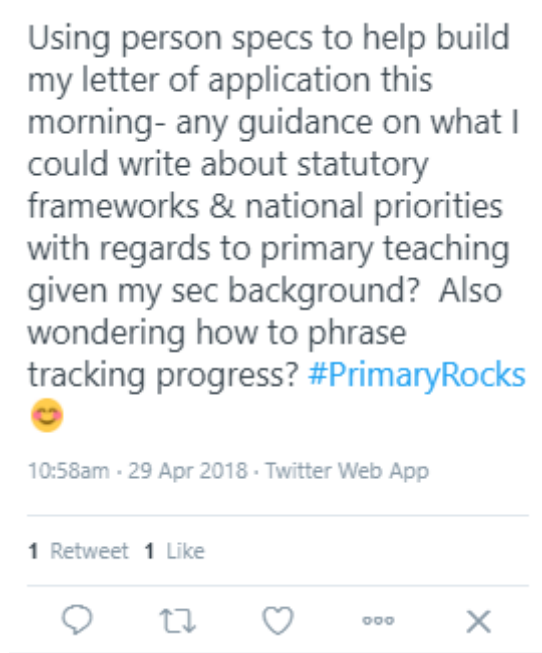
## 4.4 Research Question 3 - Why do teachers choose their Twitter tools to build professional capital?

### 4.4.1 Information literacy - Accessing the Skills of Others

Every participant describes accessing the professional capital of others using Twitter. While some access those that they know outside of Twitter, for many it is the new people drawn into their network and the ability to overcome geographical boundaries that is the most important aspect of Twitter.

For Rachel, Twitter provides a way of accessing the skills of those experienced in primary teaching. From gaining feedback from others on application letters (see Figure 4-18 ) to literacy resources to trial in the classroom, Rachel is enthused and keen to try different things that have been shared by others.

Figure 4-18: Accessing skills of others



The links to individuals does not just include those in their network but can include others who perhaps they would not be able to contact easily any other way. Rachel talks of tweeting scientist Professor Brian Cox, in the hopes of getting a response to share with her students.

An individual of importance to two of the participants in this study was Professor Dylan Wiliam and his use of Twitter. Dev is interested in assessment and testing and this raised his profile with both blog posts and discussions on the role of assessment. This high profile led to an interesting encounter where it had been his Twitter profile that Professor Wiliam knew despite having never met;

*'He said he knew me from Twitter and it was nice to put a name to the face.... I felt a tap on my shoulder and it was Dylan... he said he was looking forward to reading my blog post'*

This public space works both ways for individuals providing Professor Wiliam with access to thinking and discussions from a wide range of individuals who choose to

interact with him. This is highly significant. Professor Wiliam is telling Dev he finds him credible, has noticed his profile, a link has been established – all from with Dev’s activity on Twitter; this is then sealed in a face to face meeting. The sustained nature of Dev’s involvement and interactions over time has helped Professor Wiliam to form these views and this is not something that would have been easy to establish through a face to face medium when individuals do not have an existing relationship. The affordances of Twitter and a ‘blog’ have allowed Dev to share information with others and for Dev, Professor Wiliam and others to engage in dialogue around the practice of assessment to create a shared meaning.

Dev’s interactions with Cambridge Assessment Group meant he was invited to spend a week with their public policy and twitter team and see their work. Again, Twitter interactions have facilitated a relationship that allowed him to access and understand another’s role and organisation. Dev can see the work of a community of practice that while may sit in the same landscape is remote from his daily practice. This gives him new knowledge and understanding about an aspect of practice – the construction of assessment – that he did not have before. The relationship is strengthened by the face to face meetings so instead of being viewed as an ‘organisational account’ Dev knows the person behind it effectively putting a face to the account. Without these sustained interactions via Twitter Dev would not have been able to access this information – Cambridge Assessment Group engaged in its own influence work to allow him to understand their specific practice.

For Beth, an important aspect to her use of Twitter is the information seeking activity of asking questions of her peers. In the first year of teaching a new course, Beth asked multiple questions of others including questions about the content of textbooks, how to carry out practical activities, naming unknown equipment and checking answers. Simply asking questions did not guarantee a reply, sometimes she had one or two, sometimes she got no response. Even from one of the organisational accounts she runs, she will tweet and retweet others questions as well as providing advice from it to help others access knowledge.

For all participants, this is a significant part of their reason for using Twitter – the ability to access a wide range of information in different forms that is embedded in the social relationships that they have created.

#### 4.4.2 Direct Messaging

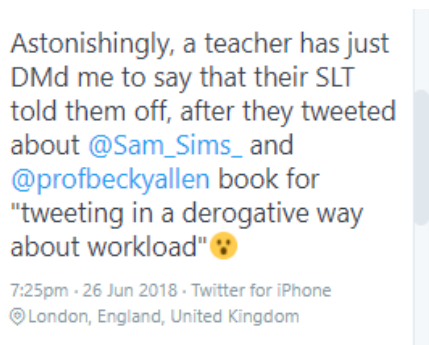
Twitter has a Direct Messaging tool that allows individuals to send private messages to others either individually or as a group of people. While the research did not look at individuals' direct messages, participants did discuss the use of this affordance. For example, Dev indicated that he was a member of several direct message groups and that the conversations carried out in these can contain conversations that are deliberately not in the public domain,

*'direct message groups and they will be far more candid in those, talking about other people. Very strange thing'*

or where individuals did not want to discuss something in public such as their workplace. While for Rachel, direct messaging has been used to warn her of getting involved in arguments as well as discussions about her transition to primary education.

Another example is the ability to let others know about issues while maintaining anonymity such as Figure 4-29, where the individual has direct messaged someone giving details that they cannot put on their own timeline. The recipient of the DM has then tweeted it to maintain anonymity of the original person but highlighting how online comments can lead to disciplinary issues in their professional life. This is another way that individuals are managing the risks involved in using the platform.

Figure 4-19: Direct Messaging and Tweeting Interaction



Private messaging is a tool to enable others to carry out conversations where they cannot be monitored by others, or limit the individuals involved. This movement of anything that could negatively impact their professional profile is from a public space to a private space. This is like the surveillance on the official boards discussed in Webster and Gunter (2018) where individuals in that research moved to use another social media affordance resisting surveillance. In the case above, the individual was being monitored by their senior leadership and this will change their pattern of use and what they then tweet in order, again, to manage the risks involved with the professional and personal identities changing or limiting the social capital available.

#### 4.4.3 Promotion of Activities and Blogs

Both Stephen and Beth use Twitter to promote a wide range of activities that each is involved in. For Stephen, these activities are wide ranging including training and conferences in Scotland and Canada, workshops delivered by international scientist and subject association events. Stephen noted that the popularity of Twitter as a platform has changed over the years. His Tweets regarding the activities in Canada he was involved in were having less interactions than in previous years and perhaps this would impact on their popularity.

Beth not only runs her own two accounts but two others, one for physics teachers needing help and one for the local subject association. Both have a large role in

promoting activities, blogs, and conferences both locally and nationally trying to ensure that individuals know that they exist but also offering help and support for other physics teachers.

Twitter is not only a place to share activities with other teachers but also for social campaigning. At a subject association meeting a teacher had raised the fact that her school was no longer offering physics courses.

Figure 4-20: Example of social action tweet



Beth and her subject association colleagues used Twitter to campaign for the reinstatement of the course on the grounds of equality of access. Beth used at least 2 of her accounts to push for people to sign a petition as well as writing to the school and encouraging others to do so. The pressure eventually led the school to offer physics, but Beth was aware that the problem could arise again and was working with others to collect data to challenge schools if it happened again.

This type of campaigning is not just restricted to the USA but has also been seen in the UK. The development of the ResearchED organisation to get more individuals involved in educational research and applying it in the classroom began from a conversation between individuals on Twitter (ResearchED 2019) and was mentioned by two research participants. Again, the information literacy practice is not just limited to the online affordances of Twitter, but is moving to face to face meetings and back again.

Many individuals produce blogs in addition to running their own Twitter accounts. Beth contributes to a collective blog about physics teaching sharing longer posts than Twitter allows with its character limit. Once written the post is promoted via Twitter accounts in order to point readers to it. On several occasions, the posts were a deeper reflection on what Beth had discussed on Twitter at the time. This is an example of when the character limit on Twitter is constraining the information produced, so individuals are switching to another platform, in this case, Wordpress, to create a shared narrative from her reflection on action (Schon 1991).

The range of conferences and events promoted or attended by the participants are very varied. From national subject conferences and professional development residential workshops, to small local conferences and even in pubs such as the BrewEd events.

Dev uses retweeting a great deal at these events, because *'retweeting is quicker and doesn't look like you are on your phone all the time.'* Tweets together with images also provide an insight into conferences for others who are not there, with the tweet Dev was talking about gaining many likes from others.

The Cognitive Science group is another collective that began on Twitter, and the use of Direct Messaging groups has allowed the individuals involved to both share information and organise meetings for a wider group, without which it would be much more difficult. It is at these kinds of events that relationships are built as

several of the participants describe and social capital is not only built, but the elements of trust and identification are cemented.

#### 4.4.4 The Teacher Life

Like a staffroom, the teachers use Twitter to share both funny stories and the frustration of the job. Beth's 'Graph fail' (see Figure 4-9) not only ended up on Twitter, but Facebook and a blog post as she reflected on what she learnt from this and how to approach it with her students. It started on Twitter when she posted pictures of badly drawn graphs from her students and could not believe that students taking an AP physics course would draw such bad graphs. She later shared a blog post via Twitter where she reflected upon the reasons for this and how she responded to her students (see Appendix H for the full blog post). Twitter was used both to share the narrative and then later to reflect on the practice that had resulted from this. This is an example of reflection on action (Schon 1991).

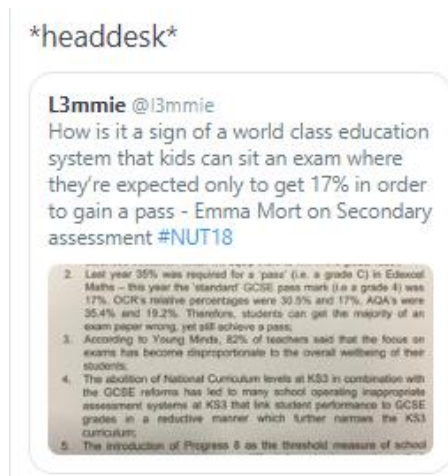
This type of conversation often happens in the school staff room or wherever people gather (Mawhinney 2010), but now with the social media, these types of comments and shared narratives are seen more widely. This can then bring issues with employers if the comments are considered unwarranted or bring them into direct conflict with the codified rules or practice.

Twitter allows those are not directly involved in education to comment on teachers and education with mixed results and misunderstandings are common. Dev explains the Figure 4-22 tweet:

*'\*head desk\* - the reason I tweeted that - another example of someone who doesn't understand how the maths higher tier paper is structured - G4-9..... They have they no idea about the new system. I didn't like that - not enough room to explain why but I wanted to show my frustration to the people who would understand me.'*



Figure 4-21: Addressing misunderstandings



This links to the ideas of shared narratives and languages in building the social capital as there is an underlying understanding implied by Dev with 'the people who would understand me' and this relationship is deepened by not explicitly explaining why it frustrated him.

## 4.5 Summary

The use of the tools in Twitter by teachers is varied and dependent on what they want to use it for. They choose to join, encouraged by another person, and begin to use the affordance to build a network that allows them access to a wide range of different information. As they engage further, they build more social capital. There are common themes within their use of the affordances – accessing knowledge from others outside their current school or location, the use of Twitter for promotion and getting new resources. The data indicates that teachers develop ways of dealing with the information flow and will quickly learn if a new tool arrives. They develop practice around the tools themselves as well as their teaching. Conflict does arise and this has implications for the personality profile

created by the individual – anonymous or named? Private or public account?

Everyone must develop practice, make decisions and judgements across the landscape. Each utterance, saying, doing or emotion are linked to the development of their practice while managing the risks involved.

## 5 DISCUSSION

To understand how individuals build their network that connects them to their information landscape, we need to understand the decisions they make from the choice to sign up to the platform. The discussion section is divided into each of the three research questions.

### 5.1 Research question 1 – How do individuals build social capital to facilitate information literacy using Twitter?

Before participants join Twitter, they already have some social capital in their professional lives. All work within schools, subject organisations and with other teachers who they have built relationships with over time. This existing social capital already gives them access to information in the social modality. To access the epistemic and social modalities of information in the wider network, it is essential that individuals start building social capital within it. This construction starts at the recruitment to the platform and the creation of a profile.

#### 5.1.1 Creating Your Identity

##### 5.1.1.1 Joining Twitter

For any teacher who chooses to use the platform Twitter and the affordances it provides to increase their social capital, there is a starting point. For two of the case participants, Beth, and Dev, it was someone who was already using it that pulled them towards the platform. Dev was encouraged by a mentor who had a higher level of professional capital (Hargreaves and Fullan 2012) than him. Beth was pulled by another asking to connect using the platform which she had not yet set up. Something about the interaction between Beth and that initial person meant that they wanted to build and sustain that relationship and Twitter appeared for the other person to be a platform to do this, hence the request for Beth's Twitter handle. For Rachel and Stephen, Twitter was the second online platform that they

had tried to connect with others before moving to Twitter. For all, there is either a motivation to join, often this is the means to connect with others but perhaps not necessarily understanding the depth and extent of information that is available in this network at the initial stages. For Dev, this began at a time when as a novice in the practice of teaching, he was still trying to take all the modalities of information from his training and entwine them in order to 'become a teacher'. It is at this point his need for all modalities of information is high and as such, a referral into the platform from someone in a position of an expert practitioner opens access to a previously hidden source of social information.

For Rachel, Beth and Stephen, the demand for information in different modalities is less immediate but still significant as they are more experienced in teaching practices. However, they all express a desire to continue to learn – to improve their performance of 'sayings, doings and tasks' that compose their practice (Schatzki 2017). This is a key motivator for them and certainly led Rachel and Stephen to abandon one platform and its affordances for another. All the participants had information needs, often at different levels from novice to experts and in different aspects such as particular courses, age ranges or stages of their career. This immediately highlights the importance of information literacy practices – the ability to find and access information required outside of their initial site of practice as a driver for use of the platform.

#### 5.1.1.2 Creating a Profile

Existing research does not explore this affordance and what it does for the individual and for others. Most simply say that users create profiles and perhaps a description of the contents of a profile. Even in the Rehm and Notten (2016) paper on the role of social capital on Twitter they only use the profile to harvest data about the individuals concerned. There is a lack of discussion around the role of the profile and what it does to support information literacy activities in networks. Empirical research links the number of followers and the 'social group' to credibility and judgements (Lee 2018) but do not explain how the social group is formed in the

first place. Even the most recent research by Nochumson (2020) discusses the credibility and judgement of the person posting, without referring to the profile. This shows a lack of attention paid to the profile as an affordance for social capital and as part of information literacy practice.

As Lloyd (2010) states, for access to some modalities of information, particularly the social modality, individuals need to build relationships with others, they need to build social capital. The profile is a crafted identity presented to the community or network, to connect with others and is the first step in building social capital. This profile is important in the structural dimension of Nahapiet and Ghoshal's model (1998) as well as in the relational dimension. The tags, profile construction and elements included in the profile increases the chances of identification with others who share the same or similar practice and therefore the increased possibility of exchange and access to other parties. The profile can also indicate the multi-membership of different communities of practice and organisations. Dev includes the details 'RSci' (registered science teacher) and 'Likes CCT' (Chartered College of Teaching) as well as the hashtag for a specific group he is involved with. Beth includes the Twitter handle for her professional association in her named account and the hashtag #APphysicsC on her anonymous @MP account whereas Stephen includes his role in the subject association in Scotland. This is because they are more easily identifiable as someone who may have the human capital or epistemic and social information another needs to access or be an expert of a group who the individual wants to access to. These details for both Beth, Stephen and Dev define their membership of groups, but also define the boundaries. If you are an individual who understands those terms or hashtags, then you are likely a member of that community; if not, then they terms are meaningless to most.

In contrast, Beth's anonymous account there is only the state name, and contains no links to major organisations. The presenting identification is that she is a physics teacher in the USA teaching #APphysicsC as an identifying marker. Leaving those details in makes it easier for her to identify and be identified by others in the

network for the purposes of physics teaching and knowledge exchange. However, by limiting the information, she restricts the ability of others to identify her as an individual and therefore link to her school.

This contrast also highlights the ability of profiles to show levels of expertise and credibility. Having the key organisations, a photograph and geographical location in the profile increases the likelihood of being regarded as credible with others and provides an opportunity for cross checking if needed. Therefore, they are more likely to be trusted. With this information missing on the anonymous account, there is perhaps less initial credibility or trust from the profile, but this can be increased with sustained interactions with others to build the trust required.

Whilst the identification element of Nahapiet and Ghoshal's (1998) model can be helpful to understand profiles, the model does not link identification to access to parties for exchange and combination. However, the profile details allow individuals to identify those parties who they wish to gain access to information by following them and so influencing the network configuration and network ties. The access for many is open, meaning that anyone can follow them, but the identification element of the model is important to identify those parties who you want to build a relationship with as well as increasing the anticipation of value. By having an open account, anyone can read the tweets, and this helps to identify the shared codes and language that an individual may use. This then means they are more easily identifiable as a core member of a group or a person engaged in similar practices that would be useful to build a relationship with. Open accounts with clear, detailed profiles allow the initial production of bridging and bonding social capital.

It is important to remember that these profiles are not fixed but fluid. Individuals can change almost all aspects of the profile they create; however, their profile is still always visible. Dev's experience of a friend changing his own profile to match Dev shows the fluidity and misidentification in practice. Even Dev was confused by the changes, and although this was done in jest, individuals with weaker ties may

not be able to re-establish those ties easily or in that moment, the opportunity to connect may be lost. Beth demonstrated this towards the end of data collection when her anonymity was compromised. Despite changes to the username, Twitter handle and profile details, the Twitter algorithm meant that she was ultimately unsuccessful, and students continued to find her account. Profile changes can cause confusion for others, leading to misidentification or the inability of others to identify the individual, particularly if the change is to the Twitter handle. This can then impact on the trust and strength of ties in the network albeit probably temporarily. However, profile changes are an aspect that can be used for individuals to manage the risk/ reward of using Twitter or raise their standing or authority in their community and network.

The profile is a vital starting point for identifying who is engaged in similar practices, who may hold information in a variety of modalities that a person may want to access. You cannot be 'on Twitter' without some semblance of a profile even if it only has limited information. To build bonding social capital, you have to identify 'your people'. To create bridging capital – you must be able to identify those who are aligned with your interests but with complementing skills and information. It allows individuals to manage risks, play jokes to build shared narratives, raise or lower credibility, change identities and affiliations, and allow individuals to configure their network. The profile is the flag that allows you to present your online identity to others and allows others to find you. Now an individual is 'on Twitter' the building of social capital can begin.

### 5.1.2 Building Social Capital - structural dimension

The structural elements of the social capital model put forward by Nahapiet and Ghoshal (1998) include the network ties, network organisation and network configuration. I will take each of these in turn and discuss them considering the data.

#### 5.1.2.1 Network ties and network configuration:

Network ties provide access to the resources, therefore, individuals using Twitter must identify and connect with those individuals who have the resources they need. While Coleman (1988) states that relations established for other purposes provide information channels, it is the individuals on Twitter who establish those relationships, precisely to gain access to the information the others possess. These ties are established by finding and following people on Twitter. As above, the profile is an important affordance that supports individuals in identifying those that may possess the information that they can use. This is the first judgement that individuals make as they build their network – who to build those ties with. There are advantages to those ties for the participants.

The ties that individuals have to others in their network reduces the time and investment required to get access to information that can be exploited. The participants describe getting information quickly through the network, including responses to questions, resources, and access to research papers. For example, Beth describes getting answers from others quickly and easily, Rachel can access information from others much more easily as the use of Twitter does not constrain her information seeking by time or location. Not only is this access faster, sometimes it is allowing access where perhaps there was previously none. For example, access to the research papers for both Dev and Stephen are important, but these are usually behind paywalls, so access is restricted. Some academics such as Professor Aileen Kennedy and Professor Dylan Wiliam engage in Twitter and will share papers freely. Therefore, there is already an advantage in accessing information through the network ties set up with experts. Individuals may have weak ties to those experts, but they can still find advantages in having this access to epistemic and social modality of information.

Just because there is access does not always mean that information is forthcoming from individuals in the network. Beth and Rachel both describe instances when no one responded to their tweets so although the ties may be there, the weak ties can



restrict how easy it is to access the information. Hansen (1996 cited in Nahapiet and Ghoshal 1998) found that those weak ties, while enabling searching, did restrict the transfer of knowledge, particularly when it is not codified knowledge as seen in the data. Stronger ties with individuals seem to allow Beth more confidence and trust so she can ask questions for clarification or for advice increasing the bonding and bridging capital between her and others. Again, indicating information and influence work as well as sharing and receiving information (Lloyd 2010). Whereas when an individual has weak ties with her, she is less likely to make the investment to ask due to a higher risk of no return, particularly if time is an issue. Stephen acknowledged weak ties when discussing aspects that he often ignores such as a debate around pedagogy, rejecting providing a response or information to those engaged in that discussion. Again, ties and their strength are key factors in individuals building social capital to create new knowledge and require information literacy to make judgements on the knowledge shared.

Rehm and Notten (2016) discuss the ability of some individuals to dominate and control communication or at least occupy a central position in the network. While this was not clear in the data, Dev's position as a leading member of a cognitive science group, and Beth and Stephen's positions within their subject associations may indicate they occupy a central position in their network. How these positions are created in terms of weak and strong ties and the information that these individuals hold both online and offline could be followed up in subsequent research.

Rehm and Notten (2016) also point out new ties are formed over time increasing the individual's network and increasingly gain access to relational knowledge and resources, but they do not explain how they choose to select people to include the network. This again is linking back to the affordances of the profile, the judgements made based on it about trust, credibility, and the site of information, otherwise why include them? Underlying the decision to include them is the information needs of the person creating the network. For Rachel, it was to find those that could give her

access to information about primary school teaching, for Beth, those that could provide information about AP Physics and this need also changed over time as she worked through the course content. For Stephen, it was slightly different, his information needs often revolved around academic research so the inclusion criteria are subtly different from the others, but again driven by his information needs, in this case his master's degree. Dev is driven to widen his network both from a pedagogical perspective, but also finding those who share his interests both academic (assessment) and pedagogical (cognitive science). With the inclusion of another person into their network, individuals are enacting information literacy practices, making the map of their information landscape larger, perhaps more diverse, or even allowing them to access information previously unavailable. All this then allows them to entwine the information together and be able to use it in their teaching practice. This is an aspect missing from current empirical research, that talks about following individuals and sizes of networks but little discussion about the reason for following or including individuals in their network.

Referrals are:

*'processes providing information on available opportunities to people in the network influencing the opportunity to combine and exchange knowledge'*  
(Nahapiet and Ghoshal, 1998, page 252).

Twitter demonstrates a range of referrals with individuals tweeting about upcoming conferences, papers, and opportunities. Embedded in these is the 'reputational endorsement for the actors involved' (Nahapiet and Ghoshal 1998, page 252). While these are important in the relational dimension, we can see this in action with the professional reputations of individuals whom participants interact with. For example, Rachel's interactions with experienced primary teachers or Beth's interaction with a highly experienced physics teacher both show that their interactions are based in part on the reputation of those individuals. At another level, the fact that both Stephen and Dev interact with leading academics in

educational research also provides further evidence. Stephen states about Professor Dylan Wiliam that 'he always has something interesting to say' showing that although the interaction is in one direction, the reputational element is important. Again, the referrals link back to the affordances of the profile. What the profile tells someone about the individual. For someone such as Professor Dylan Wiliam, his reputation has been built up outside of the platform of Twitter, by the publication of academic research, conferences and delivering training internationally. Stephen and Beth also demonstrate this within their subject association activities that will have allowed them to build trust and provide opportunities in person. Over time, interactions with others builds the trustworthiness of those offering referrals, for example, Dev's involvement in a cognitive science group over a sustained period, providing access to epistemic and social modalities of information, has built a reputation that now allows him to promote aspects of knowledge available in other affordances such as blog posts.

All through the discussion about the network ties, there is the underlying information literacy practice, identifying who has the information, where it is located, are the individuals engaged in the same practices, do they speak the same language, will a person be able to access it? Much of this is a combination of information work in locating the knowledge to form the ties and information sharing and particularly receiving through the ties created. The affordances of the profile all support this aspect when individuals have had no face to face contact. So, while much empirical research comments on the creation of the profile and uses it to harvest data about the individual, this research identifies exactly what the profile enables an individual to do to build social capital and engage in information literacy practices.

I return to this aspect in the discussion on the relational dimension (section 5.1.4).

#### 5.1.2.2 Network configuration

While the ties provide the channels for information to flow through, the configuration of the ties is also important. Nahapiet and Ghoshal (1998) give three properties of the network structure – density, connectivity and hierarchy that impact on the contact or accessibility for network members. The participants have networks that vary in density and connectivity ranging from about 500 individuals up to over 2000 individuals. As discussed earlier, the inclusion of more and more individuals into the network happens over time as individuals locate more people, they wish to build a tie with, yet does this impact on the information flow. Nahapiet and Ghoshal (1998) cite several other researchers in this area, including Burt (1992 cited in Nahapiet and Ghoshal 1998) who argues that a sparse network is more efficient as it provides both diverse information and lower access costs. When we then look at this in relation to the data, we see that participants all talk about individuals with whom they interact on a regular basis. This indicates that while they may have a dense network, there is a core set of individuals in the network who they rely on for more information than others. For example, Beth talks of three individuals who she listens to most closely than others. Stephen talks of individuals who he knows well who are using the platform. Dev is also able to identify a set of individuals who ‘get me’ all indicating strong bonding capital. Hidden in the density of follower/following numbers seems to be a sparser network that has stronger ties to the individual providing the benefits of a sparse network hidden in denser one. These smaller networks may facilitate deeper and more sustained dialogue around practice, make information more quickly and easily available and with more access certainty than those weaker ties. Certainly, in making those judgements to include them into their network, the profile is again important, however, the interactions over time appear to be the influencing factor in deciding who they have stronger ties to. Dev’s group who ‘get him’ have strong bonding capital built through sustained interactions. Leading to the conclusion that the profile influences

the judgement about the inclusion into the network, but the interactions decide the strength of the ties within the network.

However, it may not always be beneficial to have a smaller network, particularly if there is a lack of diverse views within it, as it risks creating Pariser's (2012) filter bubble with nothing new or different. While bigger networks may appear beneficial, the density of the network makes accessing information more difficult. However, the richer patterns of relationships developed described by Nahapiet and Ghoshal (1998) are important where information meaning is uncertain, or individuals differ in their prior knowledge. This can be seen in the diversity of the networks created by the participants. Often, they are engaging with individuals who differ in their levels of knowledge, Beth and Rachel for example are relative novices in their specific practice of interest, while Stephen is much more experienced and engages with academic researchers, educational policy makers or organisations. These diverse networks provide opportunities for significant developments in knowledge, for example, Dev's understanding of assessment and psychometrics, both through his own reading, interactions with academics, assessment experts and policy makers on Twitter. The diversity allows them to access more diverse practices and information increasing bridging capital while ensuring that a smaller group where ties are stronger who can provide information with little effort and more reliability with bonding capital contrasting with empirical research cited by Williams (2019).

#### 5.1.2.3 Network Organisation

The social capital developed by individuals in a professional context can be is also transferred into new social contexts (Nahapiet and Ghoshal 1998). All the participants talk about individuals who they have met face-to-face with and then connect with via Twitter. The opposite however, connecting via Twitter and then meeting face to face face-to-face, is by far the most common aspect reported by participants during the research. This is not something that has been discussed in the literature around the use of Twitter, and contrasts Facebook, where users tend

to have met first. The development of social capital such as ties and trust online and then moving into a face to face face-to-face relationship as described in Nahapiet and Ghoshal's model (1998) is important. While most of the relationships remain focused on professional practice, such as Rachel's development of primary school pedagogy, the ties, trust and relationships deepen so that individuals have a deeper personal friendship with others in the network, as illustrated by Dev, Beth and Stephen, that can function both on and offline. However, in contrast to research cited in Williams (2019) Twitter not only sets up offline relationships but allows individuals to maintain them over geographical distances if opportunities for face to face interaction are limited. They may expand their relationship to include other communication methods such as Facebook, email or text, but they also retain the ability to communicate on Twitter. For example, Rachel, Dev and Stephen describe going to face to face meetings and conferences, meeting individuals who they have only known via Twitter. Through these types of meetings emails and texts can be exchanged, adding more channels of communication to the network, rather than shifting away from one. This is an example of bridging social capital being converted into bonding social capital over time. Williams (2019) cites research that states the bridging capital and weak ties were more likely to be made rather than reinforcing bonding relationships. The data shows a more complex relationship – social media has facilitated bridging capital and weak ties, but then sustains and deepens the relationship to move it to bonding social capital.

An important aspect of the transfer of social capital to different relationships and contexts is found in the data. Rachel does describe her use of Twitter to find information and build relationships that are lacking in her organisation. While the information she entwines over time into her practice, she is failing to build any social capital in her school and seeks it elsewhere. The context in which her practice happens is not full of novel and available information about primary teaching, so she has sought it elsewhere, however, this has come at a cost. It distances her from her peers who do not understand or accept her online

information literacy practices and activities and reject the practice that she uses. The use of Twitter reduces the sense of isolation when relationships and ties within one context are weak or dysfunctional making improvements in practice difficult. Both Beth and Stephen also experience a level of isolation. Beth as the only teacher of the AP Physics C course at her school means she lacks individuals who have the information she needs to improve her practice within her physical location. Stephen is in a large town but works to support novice teachers who are even more geographically isolated and often the only subject practitioner in their own location. This is an important outcome of the use of the affordances of Twitter – the building over time of deep relationships and the relevant social capital, particularly for those who are isolated. The isolation reduced access to relevant information, so the affordances of Twitter open up the individual's information landscape, increasing it far beyond the context or geographical boundaries filling the gap in their current social relationships.

Technology is needed to build the structural dimensions of social capital in digital networks. If we are to apply the Nahapiet and Ghoshal's (1998) model to social networks, I propose the addition of the technological configuration to the structural dimension. The affordances of the technology are needed for the formation of ties and the network configuration to gain access to others information in digital communities. Without the technological affordances, combination and exchange of knowledge and the creation of new intellectual capital is impossible in social networks.

### 5.1.3 Building social capital – Cognitive dimension

Within their cognitive dimension, Nahapiet and Ghoshal (1998) explore two elements – shared codes and language and shared narratives. I will look at each of these in turn.

### 5.1.3.1 Shared codes and language

To build social capital, it is important to build shared narratives, codes and language – become literate in the genre. All these are important if individuals are to access the social modality of information stored in their social network. This is a particular issue within a practice such as teaching, where shared concepts and language is built up over time as the practice takes place and marks the boundary between those that are engaged in the same practice and those that are not.

An interesting example of this is when Dev's friend tweets something about psychometrics. This dense, highly coded statement is something that only those with an interest in psychometrics would understand, defining the boundary between Dev and others. The fact that his friend had tweeted it suggests that there was also a shared narrative behind it. In this case, the fact that P had changed his whole profile to match Dev's and then tweeted him as a practical joke. This creates bonding capital through the shared joke as well as clearly shows the complex language and codes that need to be understood to access the information about psychometrics. Other examples of shared codes arise when we look at those participants in different educational systems.

While much of the shared language may be common in the wider landscape, boundaries can form within larger communities of practice, or separate communities of practice that may all look the same to outsiders. Stephen and Beth both had to describe the educational system and details to me as the researcher as I was unfamiliar with the USA and Scottish systems. Both provided opportunities to develop language and codes that I came to understand to facilitate the exchange of interview information with me. I had to become literate in the genre of the US educational system and the Scottish education system to have a dialogue around the practices of Stephen and Beth's teaching and their use of Twitter for learning. Nahapiet and Ghoshal (1998) state that these shared narratives, codes, and language requires some sharing of a context, provides a common conceptual understanding, and enhances combination capability. Someone who is not a



teacher could perceive the practices as being the same. However, as individuals expand their information landscape, they identify boundaries between their practices and the practices of others. This then requires the building of bridging social capital in order to gain access and understanding the differences across those communities but importantly they are engaged in very similar practices.

On Twitter, this sharing of codes and language is made more difficult by the limitation of character limit. This comes into play as users cannot write endless commentary but must select their language carefully to express their ideas in a succinct way form. For example, the use of RT to indicate retweeting, the use of hashtags or 'DM me' meaning send me a private message that appear in the data at various points from all participants. This is an aspect of information literacy practice (Lloyd 2010) that is key to use of Twitter as individuals must develop not only a shared code for their teaching practice, but also their information literacy practice around Twitter. They must learn the shared codes and language about how to use the affordances of Twitter to enact information literacy quickly and easily.

The digital affordances of Twitter allow many individuals to interact with others. But this interaction can show their lack of understanding or membership of the community. As Lloyd (2010) highlights, communities can constrain the sharing of information and create barriers between groups. The lack of shared understanding and codes means that it is not always possible to join the community of practice or develop the social capital needed to access and use the knowledge embedded in the relationships. However, there is access to others if trust can be built and weak ties strengthened through a willingness of members to engage in the dialogue required, for example, Stephen and Dev both engage with a wide number of academic researchers. This can help build that shared understanding to progress from a novice to at least someone who has a shared understanding of academic practice. While Rachel and Beth engage with dialogue with those more experienced than themselves in the relevant practice. Both must develop an understanding of that shared language and code in order to facilitate the movement of information

embedded in the relationships. This allows Beth to move to become a more expert practitioner, while for Rachel, this opens access to the primary practice that she wants to become engaged in. Without shared codes and language, accessing the social information modality in the relationship individuals have built is difficult. Another layer is added onto this access by requiring individuals to learn the shared language and codes around the information literacy practices of Twitter. For a novice teacher this provides a very steep learning curve both in the practice and the technological affordances that they must master if they are to be successful in both information literacy enactment on Twitter and the practice of teaching.

#### 5.1.3.2 Shared narratives

Both information literacy (Lloyd 2010) and the social capital model (Nahapiet and Ghoshal 1998) regard shared narratives as important. In information literacy terms, Lloyd (2010) shared narratives allows individual to gain understanding of the different practices while being shaped by the history and culture of the community in which they are shared.

Beth's narrative surrounding the #graphfail is an example of sharing knowledge through storytelling that can facilitate the exchange of practice and tacit experience (Nahapiet and Ghoshal, 1998). Her blog post gives her new interpretation of the events and expresses her new tacit knowledge. This then enables her to exchange it with others, have dialogue around it and facilitate its combination not only for herself but for others. There is the creation of a shared narrative. Schatzki (2017) describes how the practice is linked to learning as Beth reflects to improve her perform in the sayings and doings that compose the practice of teaching this small chunk. She will 'better choose what to do in a practice' (Schatzki 2017). This is important in a practice-based profession such as teaching where a significant amount of knowledge is tacit rather than codified and helps individuals to develop their decisional capital (Hargreaves and Fullan 2012).

Other examples of storytelling include Dev's experience of his friend changing his Twitter handle and his experiences with the Cambridge Assessment Group and Rachel describes in detail her attempts to get a job in a primary school over a period of several months. Much of this creates bonding social capital. For Stephen this was not observed as much, indicating perhaps much more bridging capital rather than the bonding capital is in his interactions with others on Twitter.

In summary, to build social capital requires individuals to share codes, language, and narratives or if they do not share them, an opportunity to learn them. This then enables them to not only access epistemic modality of information because they understand the language, but also access the social information modality through narratives and interactions over time using the shared language and codes.

#### 5.1.4 Building social capital – Relational dimension

The relationship dimension covers the elements of trust, norms, obligations and identification.

##### 5.1.4.1 Trust

As Nahapiet and Ghoshal (1998) use Misztal's (1996) definition of trust as 'the results of intended action will be appropriate from our point of view', each interaction, each tweet and reply builds on or can destroy trust between the individuals. If each interaction is appropriate in 'our view' (that is, the view of the users between whom trust exists), the trust builds. An interaction costs little in terms of time and investment so if after a few interactions, they do not get the result intended individuals can walk away with little lost. This trust is not only built in the public domain, but in the private direct messages, the face to face face-to-face meetings and interactions off Twitter. All the participants stated individuals in their network who they had met face to face and that these relationships build trust. Individuals can retain contact across temporal and geographical boundaries, the trust may be slower to build up due to the constraints of the platform, the choice of details in the profile and the content of tweets, but the affordances of the digital technology make it easier to build and sustain trust compared to

intermittent face to face face-to-face meetings. For example, Rachel, Dev and Stephen all attending conferences meeting people who they knew online and then being able to identify and cement the relationship. This building of trust over time via digital affordances allows individuals who have done this online, to then engage in a face to face meeting has not been discussed in the current literature around Twitter and its use by teachers, more often it is supposed that all interactions are via the platform, by other means or that the face to face relationships exist prior to the digital one (Williams 2019).

Individuals who trust each other will cooperate more readily (Nahapiet and Ghoshal 1998). Equally, the opposite is observed in the data. Dev describes a lack of trust with the general population of Twitter; therefore, he is unwilling to share resources. He is more cooperative with the #CogSciSci group indicating there is an increased level of trust with those whose membership is in a closed group. This was the only time someone expressed a reluctance to share information and artefacts via the platform. The judgement had been made after seeing hearing the narratives from others of the trust and norms of the network being violated by sharing free resources for profit. This lack of sharing of artefacts by Dev did not seem to impact upon his social capital as shown by the number of followers he retained in his network, perhaps as a result of his continual interactions to build narratives, and share his tacit knowledge rather than artefacts. However, by maintaining another network via a different set of digital affordances he then was able to carry out information literacy practices such as sharing artefacts but with a more trusted group.

While Nahapiet and Ghoshal (1998) discuss the importance of trust for openness and risk taking to increase the chances of exchange and combination, they also note that it is a two-way interaction with cooperation – trust builds cooperation and cooperation builds trust. Hence the more interactions sustained over time can lead to more cooperation between the individuals such as Stephen becoming involved in the ResearchED movement or Beth and her mobilisation of her peers for

social action. However, lack of trust does not restrict the sharing of resources for some of the participants. Both Rachel and Beth have given away resources to individuals with whom they have either not interacted with or had minimal interaction. This is often appearing to be an element of obligation – returning information and knowledge into the network from which they had received other information.

#### 5.1.4.2 Norms

Nahapiet and Ghoshal (1998 page 242) cite Coleman's definition of the function of a norm as 'what actions are regarded by a set of persons as proper or correct or improper or incorrect'. In relation to practice theory – these would be described as rules by Schatzki (1996). The professional norms of teaching are in play on Twitter as well as in face to face face-to-face interactions. The public nature of Twitter means individuals know that they need to be careful about what they say, particularly if their accounts are linked to their names. All the participants Twitter data indicated that they adhered to the norms of the profession, such as not talking about poor students, parents, or difficult situations, not naming individuals or organisations, and not swearing. High profile cases involving teachers on social media who are subject to disciplinary processes (DFE 2019) mean that many UK teachers are not only aware of the issues and the risks involved but will ensure that they only post aspects that do not break those professional norms in the public feed.

Beth describes her named account as where she put all the nice, positive tweets that her school were involved in or activities that were related to her professional skills, while maintaining a second account to post fewer positive aspects thereby managing to subvert some of the norms of her profession. This awareness of the public and professional nature of Twitter is in place as soon as individuals create their accounts and set up their profiles. Individuals know that they will be judged on what they present and the implications on them if they break the norms of the profession. They are immediately making judgements in what they choose to tweet,

how they respond and what they share in order not to break those professional norms. For Beth, this was called into question when her students found her anonymous account. A discussion with her principal resulted in her questioning if she had broken norms and, in an effort, to negate the transgression, she deleted over 70 tweets in order to remove the material that could be construed as breaking the rules of professional practice (Schatzki 1996). This shows both the understanding of how norms are different for named and anonymous accounts, but also how teachers are held to account over their social media content. Beth highlights this when discussing other individuals who are anonymous and in discussions with her peers. This indicates that there may be the professional norms that constrain the flow of information in a publicly network. While the ability to talk about students, parents and peers is available in the physical location, the public nature of Twitter prevents those fewer positive aspects being aired, discussed, and shared with others. For teachers, particularly at the start of their career, such tacit knowledge on how to handle difficult situations is vital to build decisional capital. However, being unable to discuss in public means that they are then constrained from accessing this type of information.

Just because the norms exist does not mean that individuals do not break them. Dev reported the use of the direct message affordance being used to communicate by groups of individuals when they did not want their communications to become public. The private tools are being used to circumvent the public norms of the community. They provide a group with privacy, and a tool to communicate norms to new users to prevent them falling foul of the public community norms. Rachel describes the use of private messaging warning against getting involved in conflict, to prevent her being subject to aggressive tweets. This level of conflict and debate does appear on Twitter, however not all individuals are willing to get involved in those discussions. Again, the teleoaffective structures are at play as Dev is one who will challenge others and have the debate but, by using the private messaging tool, he checked that he was not breaking the norms of debate with an individual. He

demonstrates both in the moment emotion but also judgements about another's information literacy practice. While the data did not collect evidence of the private messaging, one participant reported the existence of private group chats where individuals were making comments about others. Again, the teleoaffective structures are at work as this demonstrates an awareness of the norms of professional practice in public, while providing a way to ignore them or apply a different set in private.

Other norms include not sharing email addresses publicly and again, individuals will swap to private messaging for this. Some conversations are started in public but an awareness of the professional norms of teaching mean that they can sometimes move to private messaging as well. Not sharing of resources on other platforms for profit when those resources were obtained through relationships on Twitter, along with acknowledging any resources used or acquired from others, all these norms also relate to building trust and so access to information embedded in relationships.

Strong norms can have a negative effect and lead to groupthink (Jeanes 2019), where individuals will shut down critical debate and other ideas that do not fit with their thinking (Nahapiet and Ghoshal 1998). This then inhibits both social capital and the development of new intellectual capital as individuals become rigid in their views. There is evidence of groupthink on Twitter, where there is high social capital but little development of intellectual capital by several individuals outside of the participants. The participants often choose one of two options. In Dev's case he challenges the groupthink element for example, in a discussion about cognitive psychology. In contrast Stephen chooses not to engage in the groupthink element and describes his reaction as 'I just ignore it'. This shows an element of information literacy where individuals are making judgements about what information is important and valued, and what can be ignored. Research into such aspects as groupthink in online groups and how it inhibits information literacy practices may be a further avenue of research.

#### 5.1.4.3 Obligations and identification

The obligation and identification element of social capital is more complex, and both rely on extended interactions on Twitter.

The obligations observed in this research vary from more to less experienced, to the community of practice as a whole and to individuals or small groups, not necessarily embedded in personal relationships. All the participants shared and took information and artefacts from their interactions with others and both Beth and Rachel report sharing artefacts and information back onto Twitter and so building the obligations and expectations from others. Dev also shared a resource booklet but was more circumspect over his sharing. He restricted this sharing to a smaller group indicating that he built obligations with a select group who he trusted and would not allow others to take his resources without any obligation in return.

Beth, Stephen, and Dev talk of sharing resources with less experienced teachers as an element of empathy with their position. But perhaps this also reflects an obligation being repaid when they were the inexperienced one. This sharing of artefacts or information for the practice of teaching is a way an example of information and influence work aspects of information literacy (Lloyd 2010) – supporting novices to improve their performance. For Rachel, she shares without having a strong tie to others. For example, sharing a practical on her timeline. The obligation is not to an individual, but to the community where she has been able to access and receive information, thereby returning information into the network all of which have required her to enact her information literacy practices. Obligations to the profession, the network and to specific individuals are embedded in the relationships and interactions they have with others, opening up access to across the information landscape.

All aspects of the profile as well as the content of tweets provide identifying markers to show their group identification. This then increases the chances of exchange and combination because individuals have already signposted to others



what they are interested in and this means there are increased opportunities as outlined by Nahapiet and Ghoshal (1998). The profile is key to being able to build social capital in networks on Twitter and yet, current research only considers it at a surface level such as location, gender, or profession. The identifying signals built into the Twitter profile allow the individual to make judgements in all aspects of their social capital across all three dimensions, structural, cognitive, and relational. Questions remain regarding the role of the profile in building social capital. For example, how does the profile work for those with closed accounts and deciding if individuals want to request access. Further research could focus upon the importance of the profile in building social capital and its role in teacher virtual networks.

#### 5.1.5 Combination and Exchange of Intellectual Capital

The social capital elements discussed above facilitate the combination and exchange of intellectual capital when individuals enact their information literacy practice across their information landscape. Social capital is a social affordance that provides those opportunities to collaborate and negotiate a shared understanding of the information and practice, particularly the social information modality (Lloyd 2010). The Nahapiet and Ghoshal (1998) model puts forward four aspects of this:

- Access to parties for combining/exchanging intellectual capital
- Anticipation of value through combining/exchanging intellectual capital
- Motivation to combine/ exchange intellectual capital
- Combination capability

As individuals build their network, they gain an increasing access to parties for combining and exchanging intellectual capital. Individuals locate the information within the landscape. This access then allows information to move from one party to another as individual share not only artefacts but have a dialogue over a sustained period around their practice. This combines three out of four of Lloyd's (2010) key information literacy activities – information work, influence work and

information sharing. Access and anticipation allow them to map their information landscape and understand how information is shared and what is valued, all aspects of influence work. Having gained access, individuals can begin to engage with knowledge in the network and can be directed to the collective knowledge by an expert. The access to information sharing and receiving and the value that this brings to the individuals is widely discussed in the current literature (Carpenter and Krutka 2014, 2015, Wesley 2013, Visser et al 2014, Davis 2015). However, the role of information literacy practices in this setting has not been researched.

The final aspect – that of combination capability links closely with the key information literacy activity of entwining (Lloyd 2010) the ability to bring together the knowledge and information to produce new ways of knowing and doing. However, entwining also includes the ability to locate the information and how to access it, that the technological affordances allow – again supporting the inclusion of this aspect into the existing model.

The final aspect is motivation – for all the participants their information literacy needs drive their motivation for building social capital in the network. This may be because of the sample, so we cannot generalise that all teachers have this information literacy drive, but certainly this seems to be a key driver in their continued use of the platform when looking at the existing empirical research. Again, another avenue for further research would be to analyse this across a much larger sample of individuals.

Having built a network, and its subsequent bonding and bridging social capital, individuals now have access to huge amounts of information in a multitude of locations creating a huge information landscape that is constantly changing over time. This overload of information that is at their fingertips needs to be managed and this leads us to the second research question.

## 5.2 Research question 2 - How do teachers use the affordances of Twitter to increase their professional capital?

This section explores how the affordances of Twitter are used to manage the information available, both in identification, storage and extraction of information and subsequently communicate those insights. These technological affordances allow individuals to enact their information literacy – ‘to understand what constitutes information and knowledge’ (Lloyd 2017 page 96)

### 5.2.1 Challenge of Managing High Levels of Information Flow

The information and knowledge that flows through an individual’s Twitter timeline is dependent on the size of the network and density of the connections they have made using the affordances. An increasing density means more information and then an increasing demand on the individuals to develop information literacy to manage that flow as Nochumson’s (2020) participants reported. Multi-membership of different communities of practice online also increases the volume of information flowing through the timeline. Learning to identify the relevance of information, search for information, make judgements about its credibility and usefulness and store it are important information literacy activities that individuals must undertake (Lloyd 2010). Twitter provides a range of affordances that allow individuals to do this within the platform. In addition, users expand these digital affordances to include others that are outside the platform in order to support the information literacy practices (Wenger et al 2009).

Individuals must develop digital literacy in those affordances as they carry out information literacy activities. This research question focuses on those affordances and what they bring to the information literacy practices around Twitter rather than the development of the digital literacy element.

### 5.2.2 What flows through the Timeline?

It is important to acknowledge that the timeline is constructed by the individual themselves. This must be seen through Pariser’s (2012) filter bubble of what

matters or is of interest to the individual, so no two timelines are the same. In addition, the algorithms of Twitter are at work both collecting data as well as showing what they think the individual wants to see. For most of the participants, their timeline is the sayings and doings of those individuals who the individual has chosen to include in their network with a focus for them on their professional practice.

The content that flows through the individual's timeline can be vast and constantly changing if their network consists of hundreds of people who they are following. This means that not all tweets can be given equal attention. Some tweets were more likely to attract this attention than others. All the participants reported that images are often the thing that they notice as they scroll through their timeline. Images have a bigger digital footprint and capture attention of the user more easily than a written tweet. The tweets featuring Dev and glow sticks, Beth and different science equipment, and Rachel and literacy activities, all have images attached that increase the chances that individuals' others will pay attention and interact with the tweet. This increases the likelihood they will engage with the tweet or the posts of individuals concerned. Yoon and Chung (2016) categorised tweet messages containing images. A high proportion of the tweets use images to disseminate visual information that cannot be provided through words. This was particularly common for Beth who is a novice in her AP Physics teaching as she tried to access and gain information about practical equipment. Rachel also often added images to show how she had adapted information and artefacts from primary to integrate them into her practice at secondary.

In addition, teachers in the sample also used images to express emotions and opinions, particularly memes that illustrate the opinion or emotion experienced. Very few tweets had only visual elements, more often the tweets were a mixture of both text and visual. The data then supports Yoon and Chung (2016) in the use of images and their categorisation, however, the images have an important purpose in terms of the individual's information literacy practice.

The sample has four science teachers, who are often teaching using equipment that can be unfamiliar to teachers of different subjects. This creates an additional level of complexity that is often found in science specific teaching. The use of images by teachers to illustrate concepts, show practical set ups and share pedagogical knowledge overcomes key limitations – a picture is worth a thousand words – and in this case Twitter only has 280 characters per tweet available. The tweet containing an image allows the participants to share key knowledge with others who have the shared language and codes quickly and easily without using up the characters available. The second is can difficult to describe many concepts and ideas in science, such as how Newton’s Third Law works. A picture or video clip allows the concept to be illustrated and shared without the detailed explanation. Dev noted the glow sticks tweet and explains how this caught his attention as a visual element of a practical activity, in this case rates of reaction, similarly to Stephen and his tweet without comments – another practical. For Beth, the images are even more important as she locates equipment that she does not know about and so lacks the language to explain it. Tweeting the images out to her network allows her to access to the social information in the network to identify it for her more quickly and easily than if she had written a description. In order to include images individuals, have to use other digital affordances – cameras often on phones, cropping and editing tools or screen shots. Without these digital affordances and their use in information activities, images would not be available as an affordance for them. Images, therefore, provide much quicker, easier, and more succinct way of providing information into the community or supporting the access and retrieval of information around the image when required.

Learning to adapt to the character limitations is another practice that users learn as they engage in information literacy practices using these affordances. The character limitations mean that individuals will often use images or other codes of some kind rather than words to express themselves and their emotions. For example, Dev and the ‘head desk’ tweet to express his frustration. He states in his interview that he

did this rather than trying to explain why he was frustrated or explaining why the other person was wrong. While not an image like Yoon and Chung (2016), again there is the expression of emotion in tweets, often helping to build a shared narrative with others. The increasing density of the network means that the timeline of information available becomes larger per time period and it ever changing so even if seen once, it is more difficult to find it again. As Beth found, sometimes the only way is to ask, 'did anyone post....' type tweets in order to re-establish the link to the information again. This is an example of the need to re-find information similar to Hajibayova (2019). However, the nature of the timeline means that if you do not have a method to store the information then it is easily lost in the data smog of the timeline. This also links back to social capital where the denser network means it is a slower process to access the information. This means that individuals have to learn to use the digital affordances available to not only identify knowledge that is relevant or useful, but to also store it somewhere for access later or even extraction from Twitter completely. This is a key aspect of information literacy practice that they must master in order to make effective use of what they see and interact with. While Twitter may use promoted tweets and similar aspects to increase the likelihood of a tweet being seen, the sheer volume of tweets means that individuals may miss information and make it difficult for them to go back, find and store as well as review what they have missed. This leads to the affordances for managing the information found in Twitter.

### 5.2.3 Managing Information

#### 5.2.3.1 Hashtags – Searching, Connecting and Humour

Like many social media platforms, Twitter has affordances such as hashtags and a search facility that allow individuals to search and find using key terms, names and Twitter handles in order to facilitate discussion. There were several hashtags mentioned by participants including #iteachphysics, #asechat #cogscisci and #teacherlifegraphfail. Much research around Twitter uses the hashtag as part of the

methodology including as a sampling tool (Greenhow et al 2019, Kimmons and Veletsainos 2016, Forte et al 2012, Rehm and Notten 2016). However, for the participants the hashtag has several purposes.

#Cogscisci is used to coordinate activities in original way the creator of hashtags, Chris Messina, envisioned (Parker 2011) – as a search term used by individuals to enable them to find and connect to information. This was seen in all the participants data. Both #iteachphysics and #asechat, are used to coordinate ‘Twitter chats’; synchronous interactions or chats at a specific time by allowing individuals to filter their feed using the hashtag and the search feature as seen in Beth, Dev and Stephen’s data, but not Rachel’s data. However, the coordinated conversation about some aspect of practice is not always feasible for all. Beth points out this out when chats clashes with her children’s bedtime and while she may not be able to participate at the time, she can observe and access the information afterwards using the hashtag. This is the primary use of the Twitter hashtag – to search and connect people with information in both social and epistemic modalities, synchronously and asynchronously. This also opens up access to new parties for exchange and combination as using the hashtag in chats or in searchable tweets can indicate a shared interest or practice, again, allowing identification of individuals to include in the network (Nahapiet and Ghoshal 1998). The flexibility and searchability of hashtags allow individuals to identify others who are in the community of practice or further afield in the landscape of practice is also described by Zappavigna (2012).

Greenhow et al (2019) and Kimmons and Veletainos (2016) both describe the use of Twitter as a backchannel at conferences. This is also visible in the data from the participants.

Both Beth and Dev describe the use of hashtags at conferences in order to connect with others attending the same event. Rachel, while not discussing this, did attend and tweet from events using a hashtag. This is another common use for both, as it

allows them to find others at the same conference, particularly for Dev, if there is an existing relationship on Twitter and the conference backchannel facilitates the 'face to face' relationship.

Dev also retweet those individuals instead of writing tweets himself. He states that 'it's faster' and that he then has the tweets available for later. Underlying this are the judgements that Dev is making about the tweet, its content and creator and how to access and use the information later. Embedded in the tweeting from a conference is not just sharing information and signalling affiliations (Greenhow et al 2019, Kimmons and Veletsainos 2016), but to allow the user to manage their own information with maximum impact and minimum effort. Stephen's use of the hashtag is clear in the tweets about the summer school he is involved in Canada, as an element of promoting his work there which is similar to that reported by Greenhow et al (2019) and Kimmons and Veletsainos (2016). However he also noted that there was a change in the number of responses to the hashtag. Previously there had been a higher level of interaction, hinting that hashtag familiarity may vary over time, even if the event is an annual one.

The final use is as humour, highlighted by Parker (2011) and this is also seen in the data. Beth uses the hashtag #teacherlife to share the stories of her working life as a teacher such as silly answers, building shared narratives as well as also making the tacit knowledge embedded in those experiences in them available for others. The hashtag is enabling her to share social modality information with others. For example, in her #graphfail tweets she shared her learning from her student's inability to produce adequate graphs. Beth reflects that she should have ensured that they understood what she was expecting from them and this reflection could increase the decisional capital of others who saw and read that series of tweets. Underpinning this humour is the reflection on practice (Schon 1991) which supports entwining the different modalities of information together so that Beth learnt to 'better choose what to do in a practice' (Schatzki 2017).



The use of the hashtag is a way of managing information in a timeline with an overabundance of information. The real affordances of the hashtag for searching and coordinating information are seen across the data for all the participants to varying degrees. The perceived affordances such as Beth's use for humour, shared narratives and building social capital in the community are both important information literacy activities that the participants have engaged in. Certainly, the perceived affordances of hashtags are more nuanced than the empirical research around Twitter and its use by teachers would suggest.

#### 5.2.3.2 Retweeting

Retweeting is an action that has multiple purposes behind it including aspects of enacting information literacy, and building of social capital. Retweeting was undertaken by all the participants at various times and for various purposes. For Dev, it provides a way of sharing information more quickly when at a conference as well as a way of retaining key information for later use (information literacy). Rachel retweets in order to win prizes, something that is common on Twitter to promote products. Stephen stated, there was no clear reason for retweeting, however, his retweet of the Tunnocks sponsoring NASA was part of a shared narrative with those who knew more details about his role (social capital). Beth retweeted for multiple reasons, sometimes to support others, sometimes to engage others in social action and sometimes to promote events or opportunities (both social capital and information literacy). This all illustrates the multiple ways in which a retweet is used and can be interpreted and would benefit from further study.

#### 5.2.3.3 Storing Tweets – Likes and Bookmarks

The role of bookmarking online resources is discussed in the work of Hajibayova's (2019) study and relates to the ability to find resources later. All the participants talked of saving information they had seen on Twitter that they wanted to return to ranging from links and images to research papers and funny memes. In order to return and evaluate information embedded in the tweets, individuals must find a feature that allows them to return to the selected ones when they want to. The

temporal nature of the timeline and a dense network, the ability to store and retrieve relevant tweets is important information literacy activity that participants undertook daily.

In the initial stages of the research, Beth indicated that she used the 'like' button in order to mark tweets that they wanted to return to for example, for things that had come up that she would require in the following academic year. This is because the likes were stored attached to her account so allowing her to go back to them. In the first weeks of the research – Twitter introduced the 'bookmark tool' and this had an immediate impact on Dev and his digital learning when he stated, 'only just learnt how to bookmark this week'. An individual's management of their information is something they learn as they include the feature into their digital habitat. As participants explore the capabilities of the tool, they learn how to use each aspect both in the expected ways as well as unexpected ways. This is apparent in the use of the likes tool. Twitter (2018) states:

*'likes are represented by a small heart and are used to show appreciation for a tweet. You can view the tweets you've like from your profile page by clicking or tapping into the Likes tab'.*

The previous version of this tool, called 'favourites' was used in a variety of ways (Guardian 2015) including as a bookmarking tool. Despite the change in name, the participants used it for the same purposes as its previous version, to retain access to tweets that they wanted to return to. For Beth, this was important for her to access knowledge that she knew that she would need later in the academic year or in subsequent years.

While this change was not discussed by participants it does raise further questions. How this loss of public acknowledgement has impacted on the users in terms of trust or ability to identify others in similar contexts is something that could be researched further.

Any introduction of a new feature changes the practice of the individuals as they learn use and embed this into their information literacy activities. Dev was the only one to describe his use of bookmarks. He used it to store ‘mainly research papers and links’ that he planned to return to – the exact use Twitter had developed it for in response to the users. This may indicate that it takes time for a new affordance to be adopted and embedded into the practice of users. As it was introduced during the initial month of data collection, it was not adopted in time for participants to discuss it as part of their practice. Just as participants develop practice around the tools, the tools can also develop as a result of users’ practice or lack of satisfaction with them. Twitter had responded to users’ use of the tool – whether this was a requested feature or as a result of the Twitter identifying how the affordances were being used for a different purpose is beyond the scope of the research. However, they did acknowledge the input of users during the development (Twitter 2018).

Once the individual has filtered information that they want to explore further and may have stored it or know how to access it later, it is important to understand how individuals can extract and combine this information to create new intellectual capital and then how they share it back into the network.

#### 5.2.4 Extracting the Information

Having found and stored key pieces of information including videos, research papers and social information modality, the individual has to extract and entwine it to act in new and different ways improving the performance of their practice. This is often the driver for the participants to use Twitter. This links to the concept of combination capability - the ability to combine the new information and experiences with the individuals existing knowledge and act in new ways (Nahapiet and Ghoshal 1998). Without this aspect, the new intellectual capital cannot be built. The ability to have open ended conversations with individuals to develop their understanding is valued by all the participants and is seen in the data. Rachel being able to engage with conversations with experienced primary teachers, Dev and his interactions with the Cambridge Assessment Group are just two examples that

demonstrate them exploring ideas and clarifying concepts to facilitate the integration into their existing knowledge. Beth commonly engaged in discussions with individuals who teach the same course to develop the shared understanding of the physics as well as what information is relevant to her students and what is not. These are examples where individuals are accessing the expertise of those in different communities of practice to make sense of the information they find, developing a shared understanding of both the knowledge and practice, and be able to entwine it into their existing knowledge. For some, such as Beth, the information found on Twitter triggers the recall of forgotten knowledge experienced in another context as well as overcoming a problem she had found when teaching. The corporeal information received during her teaching, had identified an issue with a science practice, then the experience of seeing the same practice as an image with a modification that provides a solution to the problem. The extraction of the knowledge often depends on the current state of knowledge and access to discussions round it for clarification and understanding – the social information modality.

Several of the participants describe what happens when they cannot combine the information into new intellectual capital. For example, Beth states:

*' [I cannot use] a lot of the stuff with Arduinos cos my electronics expertise is not that high so I can't do that and the cost of it'.*

This shows both an awareness of her own expertise in one aspect of her practice – her ability to do electronics but also the context restrictions such as finances. Rachel also described a situation where financial pressures are restricting the combination capability. She could not access the resources required to even trial the strategy and so could not integrate that information into her practice. This shows that even when Twitter facilitates the access to information, the site of performance of teaching practice, or the existing knowledge of the individual can constrain the integration into practice. The information shared is not 'quality' as

defined by Whitworth (2009) as the individuals cannot extract and integrate it, so the information is unused and is not entwined with the existing knowledge.

A high combination capable individual will be able to extract, transform and integrate with much less information than a less experienced individual, because they may have more existing knowledge in which to entwine it with. Beth demonstrates this when she describes the fact that she does not use Arduinos, or when she is unable to extract enough information to work out how to carry out herself. Both these examples demonstrate an awareness of both the knowledge and skills required but being unable to transform and integrate into the new situation because not enough information is being made available.

If combination capability (Nahapiet and Ghoshal 1998) lies with both an individual and a group, it requires highly skilled individuals and experts in order to provide knowledge and information and to support individuals in extracting it – they all enact their information literacy practice by influence and information work, as well as sharing and receiving information (Lloyd 2010).

A novice needs to engage in discussions about practice with experts to gain an intersubjective understanding social information modality they are accessing. Both Beth and Rachel ask others for further information in order to support them integrating it into their current practice. Stephen is the expert, often answering questions and engaging in discussions to support novices, while Dev and Beth move between the two – novice in some areas and expert in others.

Combination capability, therefore, is the ability to extract, transform and integrate new knowledge both as a group, but also as an individual. Higher combination capability in the individuals means that they can work with less initial information, for example, extracting from a photograph or video. They can recognise the knowledge and skills required as well as a better understanding of the context in which they are in, so are more likely to extract and combine the information. Beth calling on a more experienced colleague to answer questions about a practical that

they had shared shows the less combination capable calling on support— negotiating new elements of her practice via dialogue. This is all an enactment of their information literacy practice – they are carrying out the entwining activity. Combination capability is the ability of the individuals to carry this out with the information they have. Combination capability can be supported by others or constrained by others depending on the community and the relationships within it.

In summary, combination capability resides both in individuals and groups. A group with high capability, can make judgements about with more abstract or less information. Those in the group who have lower combination capability can then call on the individuals with higher capability in order to help them understand the information. This links back to the access to experts in the model – a lack of experts lowers the combination capability of the group. This may explain the findings of Leana and Pil (2006) where individuals who have high social capital get better results because the social capital is facilitating more artefacts and dialogue around what good practice is, allowing them access to much more social and epistemic modalities of information. The higher social capital supports the entwining of this into practice and therefore improving the results of the students.

When individuals are high in combination capability and entwining new information with their existing information, they then can produce the new intellectual capital including new artefacts for discussion or practice.

#### 5.2.5 Other digital affordances

From both the pilot study and the main data collected, participants mentioned the use of other digital affordances that they used to support their information practices. Every participant used the camera embedded in their phone to support their activities and this perhaps is the most common digital affordance simply because Twitter is accessible via the app on the phone as well.

Other digital affordances mentioned by participants included the use of cloud storage such as Dropbox (Dev, Rachel, Stephen), blogs such as WordPress (Beth),

apps to extract video clips from Twitter (Beth), emails (all participants) and email subscriber lists (Dev). From the data, the most common of digital affordances tended to be email for quick and personal contact and cloud storage for the sharing of large files that cannot be attached to emails. These other digital affordances are used when the constraints of the platform's limitations cannot be overcome such as sharing files and artefacts and when information is to be shared either privately (email, cloud storage), or publicly (blogs, cloud storage links). Of interest is the use of Twitter to form a new community of practice around cognitive science. While initially all interactions and discourse took place on Twitter, increasingly the group found the affordances limited their information practices and so added another external affordance – the use of email subscriber lists to move beyond the constraints of the platform and develop their practice further. Discussion of this type of configuration – formation on Twitter and further interaction in an alternative digital platform has not been seen in the research on teachers use of Twitter. This shows that we cannot consider Twitter in isolation but must consider other sites of information literacy activity for an individual. They will have made informed judgements about the appropriateness of Twitter and its affordance and how these fit with the information and learning needs of the group. The move to this new platform indicates the constraints of site are inhibiting the information literacy practices and as such, individuals find affordances and sites that reduce or remove those constraints, while maintaining control as someone has to monitor and coordinate the list. Twitter as a site for information literacy activities still remains an option for users, who continue to use it during face to face face-to-face events indicating a multi-channel element in the enactment of information literacy practice.

All participants described receiving artefacts from others via other digital affordances such as cloud storage and emails. These provide the opportunity to share textual information such as booklets and worksheets. Even when the limitations of attachment sizes to emails are restricted, the sharing of cloud links to

allow direct downloads overcomes this constraint. This leaves the only restriction being if the individual wants to share the information with others, either selectively or publicly.

Researchers need to consider the whole configuration of sites and digital affordances order to see how individuals to build professional capital. We cannot assume that the affordances of one particular platform are the only ones used by individuals, but that multiple platforms and digital affordances may be in use, some visible and some less so. Practice is unfolding across time and many different locations as Schatzki (1996) describes. This use of two platforms or affordances, simultaneously, and what they bring to the information literacy practices of individuals could be a fruitful avenue of research. Questions should be asked such as how they decide which affordance or platform to use for what? And how their interactions are similar or different across the platforms could be considered.

#### 5.2.6 Sharing knowledge

The individuals tend put information into the network to individuals who may see it as irrelevant and filter it out, however, this is not always the case. Information flow is not one way. All the participants describe sharing knowledge, artefacts, and ideas back into the network. This is more evident in Stephen's tweets in contrast to Beth or Rachel. Stephen is a highly experienced teacher and leads professional development for other teachers. In the Nahapiet and Ghoshal's (1998) model, Stephen could be considered one of those experts that individuals are looking to access – a key element in the development of new intellectual capital as he is a source of information that people want to access. However, even less experienced teachers, such as Dev, have contributions to make and knowledge to share so it is important we understand the tools individuals use in order to facilitate the movement of information in all its modalities.

A common example in the data was the use of cloud storage and links to being shared via Tweets. This is a way of individuals to share artefacts produced within



different communities of practice to others who can then pull it into their practice. Those artefacts can range from simple card sorts (Beth) to full booklets for teaching (Dev), and even from quite different settings (Rachel). The combination of the ability of Twitter to share the links, the development of cloud storage to allow sharing of access with others has facilitated not just of small files with a select few individuals, but large files with anyone who has the link. This is allowing the dissemination of the artefacts across a much wider audience across time, as the links are often active weeks and months after the original posting, facilitating sustained sharing for those that find it. The information and artefacts no longer have a time limit to access provided you have the link and the file is there.

The sharing of images and video clips was undertaken by all the participants to overcome the limitation of the character length and to facilitate the sharing of knowledge. Beth tweeted several images and video clips with a short-written commentary to illustrate a motion practical. For others within the community of practice, there is then the opportunity to see the science in action rather than relying on a written instruction, a static image, or a long stream of written tweets. An image tweeted by Dev of the language roots of the word photosynthesis from a conference, not only shared his surprise at his own learning, but allowed access to others to access information being shared in face to face face-to-face meetings widening access to this information. The understanding of both those examples requires the social capital in the community of practice – particularly the shared codes and narratives. This illustrates that individuals are both seeking and sharing a range of modalities of information.

They then in turn, adapt, change, or negotiate the information and integrate it into their own practice in their own classroom and can then share the newly created artefacts back into the information landscape to go through the process again. They are not simply just taking information, but it is an iterative process of access, identification, storage, retrieval, meaning making, entwining, performance, reflection and sharing.

Individuals enact their information literacy practice in a multitude of way on Twitter, but this requires them to develop digital literacy in the use of the technological affordances, not just of Twitter, but a whole host of others. Twitter enables the building of networks across geographical boundaries, while constraining the number of characters that can be used. Technological affordances used by individuals can overcome many of those constraints to enable them to access a large information landscape, but this is not without its risks.

### 5.2.7 Risk Management on Twitter

As identified by Pariser (2012), Shenk (1997) and others, there is a darker side to the rise of social media, not only the lack of diversity of information being filtered to individuals. Teachers using social media have to manage the risks involved including how they present themselves to others in the profession, but also the parents and students. This section looks at how individuals use the affordances to do this. This was not something that was considered when the research questions were written, however, it subsequently became clear that this was a particular issue.

#### 5.2.7.1 Open and closed accounts

As Nahapiet and Ghoshal (1998) point out – not all social capital is reinforcing and within the network there are misunderstandings, conflicts and unwanted communications. There are risks to being on the social media including violating the norms and trust of the network and professional practice and being identified by others when you wish to remain anonymous.

The most commonly used risk management feature is the ability to have open, publicly available, and searchable accounts or locked accounts. In the research design, the choice of having participants using open accounts was made, both for practical reasons and because ethically it placed their tweets in the public domain.

The participants had open accounts allowing anyone to connect with them in their network. This is important for those, such as Stephen, Beth and Dev who promote

aspects such as events, professional development opportunities as they are carrying out referrals (Nahapiet and Ghoshal 1998). During the research, Beth is linked to her anonymous account. As a result, she locks her account meaning only her followers can see her tweets. This means that Individuals who have locked accounts have to vet who can see their tweets. They have much more control over who sees what they are doing but they are less likely to be found by others looking to network as individuals cannot retweet their tweets so there is limited sharing beyond their own network. This may limit the density of the network as individuals find it more difficult to identify them as sharing the same practice as they have only the profile to make that judgement on. The decision to have open and locked accounts is another example of how individuals control access to information in order to manage the risk to themselves and their professional identity.

#### 5.2.7.2 Conflict

Conflict is something was only observed by teachers on Twitter in the UK according to the data. Only Beth did not report experiencing any aspect of conflict during her interactions.

Rachel described Twitter as 'tribal' while Facebook was 'cutthroat'; pointing out that with the features embedded in Facebook, users can actually be removed from the group and isolated, indicating that there is also formal administrator within that platform controlling participation. With Twitter, users cannot be removed from a group but can be blocked by an individual. Someone who has been blocked cannot see the tweets, followers list, or direct message them and follow them. Effectively they are removed from an individual's network. Even when individuals retweet – those blocked do not see the tweets.

Dev said he had used blocking more in the past year, than previously. This shows how he is using this to remove individuals from his network and this is particularly important given his description of how physically agitated he can become during high conflict interactions indicating the teleoaffective structures in action. Dev

reported that there is a physiological reaction that is similar to that experienced in dealing with conflict in face-to-face interactions. Rachel and Stephen both commented on the conflict that they have witnessed and how they dealt with it. For Stephen, he chooses not to engage in the debate or if he finds the person's comments unpalatable, he will either unfollow or block them. Rachel sometimes chooses to become involved or is warned not to. For all the UK -based participants, there is a decision to make – getting involved or not, unfollow or not, block or not – each step increasing permanence of the removal of the person from the network and the loss of access to the information stored in that relationship.

Rachel describes the use of mute for a conversation when someone began an open-ended conversation that triggered many replies for which he got a notification. Dev describes how he muted an individual who he felt was stirring up conflict so removing him from his timeline, but still allowing him to access the tweets if he chose. The mute is less drastic than the block function, it merely stops the individual from getting notifications of mentions, removes tweets from particular people or containing particular words. Muting can be done by an individual, who can still choose to see the muted content, but the person muted does not know. This again is filtering the nature of the timeline – the information to which people have access to. They are enacting information literacy practice when they choose to mute particular words or phrases, or by removing individuals who they no longer wish to see the information from without destroying the network ties and access to them permanently.

Conflicts can arise from for a range of possible reasons; from misunderstandings due to feature limitations such as character numbers to deliberate manipulation of information or individuals changing positions on key ideologies. Three key events occurred during data collection. Beth deleted a history of tweets when her anonymous account was discovered, for those that do not delete older tweets and have changed position, the change is much more visible. Dev also noted that an individual who he recalled being a big supporter for a marking policy – triple impact

marking- had changed his position and as Dev said, 'I can't find anything on it from him now'. Individuals can use the features of the platform to rewrite their history or be challenged if they try to. Twitter has affordances for individuals to edit the textual information they have shared in a social modality. Dev describes how an individual was 'stirring up trouble' and deliberately manipulating the information given and yet, because of the individual's previous tweets that were available, Dev was able to call him out and challenge him on this change. The ability to go back through an individual's tweets means that it is possible to identify see the changes in thinking, knowledge and the information supplied. This highlights an issue when we look at the history of someone's Twitter feed as a data mining exercise. The ability of the user to edit their tweets and remove content means we have to be cautious in the use of historical Twitter data, therefore collecting as you go is perhaps a better method for data capture.

Even when conflict is brewing, the use of direct messaging can avoid the misunderstandings. Dev describes having a direct message conversation with someone who he was in a public conversation with. Dev wanted to ensure that his comments were not perceived by the other as confrontational and to build understanding across what was both a community boundary and a possible cultural boundary due to geographical distance. This use of the direct messaging affordance allows a less public check that the individuals had shared understanding of the discussion thereby avoiding conflict. Rachel reported receiving direct messages warning her not to become involved in discussions that were becoming volatile and likely to result in conflict. Again, this affordance is being used to manage conflict situations. This was difficult to identify in this research as there was no access to direct messages of the participants.

A final point was that conflict, blocking and muting was discussed by the three UK based participants but not by Beth in the USA. Nagle (2018) points out there is a lack of diversity in the research into Twitter and its use by teachers. Those who do not participate because of such issues as abuse or restrict their participation are

often missing from the research and a study into the reasons for this would be for further research. Of particular interest would be the negative experiences of ethnic minority teachers use of Twitter, and of those who are part of the LGBTQ community as they are underrepresented in current research.

#### 5.2.7.3 The Risk of Groupthink

While all the participants valued the diversity of the voices that they had in their network, there is always the risk of Groupthink within Twitter. Shenk (1997) and Whitworth (2009) both describe the formation of microcultures where individuals follow those who confirm their own view. Only Stephen reported unfollowing an individual because he did not value the opinion, but this does not provide solid evidence of groupthink. However, the discussion of conflict on Twitter by participants indicates that there are differing views and that this could be evidence of groupthink in action. Perhaps hidden in the direct messages is the evidence of groupthink in operation where the norms are different as it is a private space. Whereas on Twitter there appears to be a diversity of voices, it does depend on who a user is following, the ability to attend to information that confirms our views and the nature of the connecting to those like us. This means that participants may not be aware of groupthink or being part of a microculture because they only see through their invisible filter bubble. This can then limit diverse information resulting in lower social capital without them realising. However, Nochumson's (2020) recent research indicates that the diversity of information available is highly valued by individuals and this is reflected in the data from this study. Therefore, I cannot discount the possibility of groupthink, but this study did not provide clear evidence of its existence.

Having discussed the construction of the network, the affordances used to search, organise, store and retrieve the information, and the way in which individuals manage the risks involved, we reach the final question – why do teachers choose their tools to build professional capital?

### 5.3 Research Question 3 - Why do teachers choose this platform to build professional capital?

This final question focuses on what the affordances of Twitter bring to the individuals' professional practice, particularly how they have increased their professional capital by engaging in information literacy practice in this site.

#### 5.3.1 Why use it?

All four participants are using Twitter to build their own professional capital – increasing their human, social and decisional capital to improve their professional practice. Twitter provides affordances, opportunities, and access to the different modalities of information, particularly the social modality. The ability to access highly regarded individuals who are not easily available in other contexts, combined with the ongoing conversations and sharing of artefacts are considered important for the participants. Yet, this needs unpacking to understand what it gives to the participants as they enact information literacy and the impact on them and their own professional capital.

#### 5.3.2 Larger information landscapes

For all the participants, Twitter has broadened their information landscape. For two of the participants, Stephen and Beth, this extends across geographical boundaries to sites of knowledge that would have remained hidden from view without Twitter.

For Rachel, she has increasing access to primary pedagogical knowledge that she needs to move from one community of practice (secondary) into a related one (primary). Twitter has provided the affordances to enable her to identify individuals who work in primary settings, and possess the information and knowledge she needs to develop her practice in order to facilitate the transition from expert secondary science to novice primary school teacher. Without this, her transition

would be much more difficult. Information from Twitter has been extracted and entwined with existing knowledge to produce new ways of thinking and acting in the performance as a teacher according to all the participants. Individuals must learn the sayings and doings of their practice and part of the movement from novice to expert is gaining epistemic, social, and corporeal information and entwining it to use in practice. Corporeal information is important in teaching, and yet its sharing via Twitter was only seen briefly in some video clips by Beth. Twitter constrains access to this information modality precisely because it is a virtual one, so much of the knowledge that is shared is done using the shared narratives and stories embedding in the social modality.

Another aspect raised by three participants was overcoming the experience of isolation. For Rachel, her isolation is due to little social capital within her school where she feels unappreciated, while Twitter provides the emotional and professional support that she craves. For Beth, the isolation is due to her being the only teacher in her school teaching this particular course and it being the first year she is doing this. She is able to develop her literacy about practices in other schools across the USA, as well as colleges delivering Physics. Her use of more than one account demonstrates how the affordances of Twitter are used for different purposes and manage her information needs without losing credibility. Stephen is slightly different, using Twitter to share ideas so that others who experience isolation can gain views of the landscape such as teachers in even more remote locations than himself. He facilitates the discussions and activities that enable others to improve their practice, both via Twitter but also face to face. Stephen also ensures that his geographical location does not isolate him from aspects of science education south of the border where there are similar practices, but key differences too.

Crossing organisational boundaries is a feature of all the participants, as they all access information from others who do not work in the same organisation as them. This is clearly demonstrated by Dev's interaction with the Cambridge Assessment



Group. His interactions not only increased his access to a related organisation and their practices, but then allowed him to gain access to this community to see their practice in action – an activity normally closed to outsiders. For Stephen, he uses the affordances of Twitter to share information within several different roles including as part of the subject associations and an international organisation. Both crossing boundaries of communities of practice as well as managing multiple membership of different communities of practice.

All the participants reported that a major pull factor towards their continued use of Twitter was the usefulness of the information they find through the social capital built in Twitter as reported in existing empirical research (Carpenter and Krutka 2014, 2015, Wesley 2013, Cho and Rangel 2017, Davis 2015). This information is allowing them to improve their practice and because this arrives often faster than traditional channels of communication about practices, gives them an advantage over others. Their engagement in building social capital through the different dimensions is because they see the value of the information that they can access, have the motivation to improve their practice with the information they are likely to find and have the combination capability to entwine it into their existing knowledge for improved performance (Nahapiet and Ghoshal 1998). The affordances make this possible across geographical, organisational, and temporal boundary opening up the larger information landscape for them to draw on.

### 5.3.3 Moving information across Communities of Practice

Twitter's digital space supports the community of individuals who are involved in the discussion and development of teaching practice, while engaging in information literacy practice using the digital affordances of Twitter. All the participants are looking to bring new information into a community of practice, even Rachel, who finds this new information is rejected by her peers. Each participant has built relationships with to enable access to the social modality of information that supports them building their professional capital. This requires the climate of trust with others that is built over time.

Within the digital platform of Twitter, artefacts are used for facilitating communication, enabling collaborative working and the sharing of practice. Digital affordances used by the participants to facilitate this include the cloud storage and sharing of links, direct messaging of emails to allow artefacts to be shared, photographs and videos. This is an aspect valued by all the participants and relates back to the social capital model - access to others knowledge and the resources embedded in those relationships (Nahapiet and Ghoshal 1998). The conversations seen in the data such as Beth's conversation about the capacitor practical, show that we cannot assume that it is simply transferred from one community to the next. In practice, Twitter's affordances allow a dialogue between parties in develop a shared understanding of the information and any modifications that might be required in a different context or classroom. Burt (2005) identifies that the more specialised the language within groups, the more difficult it is to move information across again, this links to shared language and codes being needed and this is often built through interactions over time and around artefacts between individuals in a network. This is seen in multiple areas with all the participants, from Stephen clarifying aspects to others, to Beth asking questions, to Dev and his interest in psychometrics and Rachel's use of primary literacy techniques. The sustained interactions have increased as trust and credibility within the relationships they have been built. This then allows common understanding of language to develop to understand the information and integrate it across the boundary of a community of practice.

The movement information across from Twitter to other communities of practice is not a forgone conclusion. Rachel is in a position of uncertain legitimacy as she describes trying to get her colleagues interested in her new ideas with little success. She exercises skill and shows resilience in the position that she is in, as demonstrated by her ability to bring the practice from Twitter, apply it in her own practice and gaining praise from those in positions of power. Yet this does not translate into changes in the practice of the community as a whole. This conflict

between her membership of the community on Twitter and the community of practice in her school affects her deeply, again showing the teleoaffective structures at work. While others may also be considered mavericks, it is possible that there are other power dynamics at play such as their positions of responsibility within their school. In contrast, Stephen's more powerful position as a head of department confers increases legitimacy of his position and the knowledge he possesses, and he is able to leverage this to change the practice of his community.

Enacting information literacy gives individuals an advantage by access to different, diverse information. This requires individuals to translate the information into a change in practice so, if information literacy practice gives individuals an advantage how does this appear in their professional capital? This is the subject of the next section

#### 5.3.4 Increasing the Professional Capital

This influx of information that is then entwined allows participants to report a change in their practice. As Schatzki (2017) points out learning is the improved performance of the sayings and doings of a practice, being able to perform more of the actions of that practice and being able to better choose what to do in a practice. This description meets the requirement for the improvement of both the human and decisional capital described by Hargreaves and Fullan (2012). The element of social information modality sharing tacit knowledge in the form of shared narratives and stories is a key element in developing decisional capital as it is not accessible in epistemic modalities. Social information is only available because of relationships built using social capital. Of course, this improvement still requires corporeal information as individuals engage in the performance of teaching.

These activities may explain why Leana and Pil (2006) find that increasing social capital increases student achievement and why teachers with low social capital working in environments with high social capital also do better. They have access to

the social capital of others and the information that comes from the relationships with colleagues who have high social capital.

Professional capital links to entwining through combination capability. The ability to extract and integrate the information with their current knowledges increases human and decisional capital. Knowledge that cannot be extracted and combined remains inaccessible so cannot be drawn on to increase the human and decisional capital of the individuals. For example, when Beth states that she saw something that could be useful but 'maybe I'll figure it out someday', this indicating an inability to extract and combine and prevents her increasing her human and decisional capital. At the other extreme, Dev's information literacy activities around assessment has increased his human capital - understanding of assessment methods and his decisional capital – the ability to select an appropriate assessment for his students and recognise the limitations of assessments.

Beth provides an opportunity not only for others to increase their decisional capital with her #graphfail blog post but also carrying out reflection on action (Schon 1991) – an important element of learning. By understanding what has gone wrong she realises that she made the wrong decision and will correct that in subsequent teaching, increasing her own decisional capital. This enhances others' decisional capital as they can draw on her experience – the tacit knowledge. Many of the tweets from the participants show similar reflection on action, increasing their own and others' decisional capital as this reflection is now in the public domain.

This increase in professional capital is also enhanced by drawing on the social modality of information embedded in relationships with their peers on Twitter for innovation and their reflections on their own practice. It can be supported by the culture of the school in which they operate, such as with Stephen, Dev and Beth, or it can be undermined by the culture, such as with Rachel. While Rachel was the only one indicating a very uncollaborative culture in her school, Beth reported some

ability to collaborate with others, all the participants value the collaborative culture developed in the network of Twitter over time.

In summary, having high social capital and leveraging those relationships for access to information including artefacts and dialogue around practice increases human and decisional capital, which in turn increases their ability to perform their teaching practice. This increase in their performance then opens doors in an individual's professional career, giving options for promotion, or in Rachel's case, options to move out of her situation. This is facilitated across temporal and geographic boundaries using Twitter and its affordances. The greater the ability of an individual to use those affordances, the greater potential they have to build social capital, and enact information literacy practice leading to the subsequent increase in professional capital.

### 5.3.5 Drawing it all together

In the digital domain of social media networks, social capital is vital to build the network and the relationships embedded in it. Without this network, there is no access to information. Social capital formation is essential in understanding the information literacy practices in the network. The affordances of Twitter allow individuals to enact information literacy practices across the network in order to improve their performance of teaching. Like much of the empirical research in information literacy (Lee 2018, Westerman et al 2014), the importance of credibility and trustworthiness are vital. This is built with individuals by a range of affordances, from the use of the profile, hashtags and gifs for humour and bonding social capital, to the ability to use direct messaging to check for misunderstandings and subvert the public norms of teaching. Sustained interactions, involving sharing narratives, artefacts and discussion builds that trust and credibility over time for those that do not already have a high profile from their non digital activities.

The importance of the profile must be acknowledged; this is the first decision a novice makes, and the thing that others will make judgements on. Those

judgements including whether they share interests, share similar practices, are trustworthy, credible, and ultimately, whether they will add worth to their network. The lack of empirical research on this aspect of Twitter is something that should be explored further.

Having created a network of individuals interested in similar or diverse aspects, the information flows through a timeline constantly. Again, the empirical research from information literacy points to those activities that are important in this context. Hajibayova (2019) discusses the activities such as bookmarking, searching and re finding information. For users on Twitter, the evolution of the affordances means the perceived affordances now match the real affordances of the likes and bookmarks tool. The ability to store and retrieve information using these is vital in the information literacy practices that are seen on Twitter. Information that is lost in the 'data smog' cannot be entwined and combined with existing knowledge to act in new ways. Therefore, the bookmarking of tweets is vital as 're finding' of information is hampered by the temporal nature of the Twitter timeline. What participants bookmarked varied widely, from funny pictures and short video clips, to academic paper access. Retweeting was also used as a method of bookmarking for Dev during conferences, as it was faster, when his focus was on face to face interactions.

Hashtags as well as the search function allow individuals to find relevant information, to bring people together at specific times to talk about practice, and even work as a methodological tool for researchers in existing empirical research. Hashtags also increase bonding social capital and develop shared narratives allowing access to social information, often as shared humour.

Many of constraints of the digital affordances on Twitter are overcome with other digital affordances outside the platform. The use of hyperlinks, cloud storage to share large artefacts is common. The camera overcomes a character limit as individuals photograph and tweet the page of text and Beth described using

another application to extract video from a tweet. When the affordances of the platform are too limiting, users will go and find other digital affordances to allow them to better engage in information and influence work as well as sharing. The move to blog posts is the most common, however, the formation of new communities of practice required new affordances outside of Twitter, allowing this community to share information in more than one way. The participants have multiple ways of meeting their information needs using the digital affordances.

The type of information that users engage in is primarily in the epistemic and social modalities. As this is virtual space, the corporeal modality of information has to be transferred into text in order for others to access it, requiring reflection on action (Schon 1991) and this is very difficult (Olsson and Lloyd 2016). The use of video is sometimes used to share corporeal information, but this was not seen in the participant data, only by the researcher in the course of this study.

The majority of information moving round the virtual space is in textual form as artefacts, however, many are the tools of practice so enable users to engage with the practice through their use of them in a different location from their acquisition. These sources of information are considered legitimate along with aspects such as shared stories of experiences, images of student work, extracts from books and discussions from experts within the field. When individuals stumble in to comment on the practice of teachers, as Dev experienced, the users are quick to dismiss the comment as illegitimate, closing off access to the information that the person would need to understand the practice. Lloyd (2010) describes how this behaviour can prevent novices entering the community. This type of behaviour may well push individuals out of the platform, as Nagle (2018) states this disproportionately affects those from minority groups and women cutting off a valuable source of information for those groups.

## 6 CONCLUSION

In this chapter I return to my research questions and outline the key findings of the study and its contribution to the knowledge around digital professional development. I then discuss the implications of this study both on my professional practice and for future research.

### 6.1 Findings of This Study

This study investigated how teachers use the tools embedded in Twitter for their professional development. This was done using both the collection of data on usage as well as repeated interviews with participants over a period of five months. Concepts such as communities of practice, brokerage, social capital and professionalism were used to explore the complexity of both the tools of Twitter, and its use to build networks, and facilitate knowledge movement and combination in order to build professional capital.

The following research questions were addressed:

- 1. How do individuals build social capital to facilitate information literacy using Twitter?** This question focused on the affordances of Twitter to build a network, increasing the social capital of the individuals. I focused on aspects such as the users' profile, the choice of who to interact with and how to present their 'online presence' in the network.
- 2. How do teachers use the affordances of Twitter to increase their professional capital?** Having built the network to increase social capital this question explored how the affordances of Twitter are used to manage the information made available. How did they enact information literacy in the information landscape to identify, store and extract information and subsequently communicate this to others? This is a key aspect of their information literacy practice that impacts upon their professional practice.



**3. Why do teachers choose this platform to build their professional capital?** This final question focused on what the affordances of Twitter bring to the individuals' information literacy practice to improve their professional practice, particularly how they have increased their professional capital. While teachers may not be aware of the term information literacy practice, they are enacting it, through their decision to use this platform. What motivated individuals to engage in information literacy to connect them to the practice of teaching?

This was conducted against a background of increasing research into social media platform use by teachers, and research into digital information literacy practice. This research looks at how teachers are enacting information literacy practice via the affordances of Twitter. This is a contribution to knowledge in both information literacy practices and in the use of social media by teachers.

Qualitative methods including interviews and collection of digital data such as Tweets were used before presenting the data as a chronology of affordance use, from the point of joining, showing how teachers learned to optimise their use of these digital affordances and manage the risks involved.

There are three key findings from this study that I will now outline in addition to other broader findings.

Nahapiet and Ghoshal's (1998) model of social capital works well when being applied to digital networks, however, there is a need to update it in view of the development of virtual networks and digital technology. The need for users to be able to use the digital affordances are vital if social capital is to be built in these virtual networks; practices around those digital affordances develop and so the technological elements should be included into the structural dimension of the

model. The technological affordances will shape the network, access, identification and requires the development of a shared narrative around it.

Additionally, for virtual networks such as Twitter, identification should be linked to access to exchange and participation. Access is not restricted in the same way on Twitter as in face to face relationships. The teachers in this study had access to information from people such as Professor Dylan Wiliam, without having built a personal or professional relationship with him. The access came through identifying him as potential source of information.

Within the model there are many key aspects of information literacy discussed, such as the role of trust, access, identification, obligations, and filtering indicating that this is useful model when looking at the role of information literacy practices. The social modality of information relies on social capital, so to understand the information literacy practices around this modality, an understanding of how social capital is created is required.

Most research assumes that each person has a single account. Beth's operating two accounts for two different purposes and set ups shows the ability to select and use Twitter for information literacy practices both as a publicly identifiable individuals as well as an anonymous member of the teaching community and an awareness of the difficulties and dangers of this public mode of communication. This brings to the fore the challenges faced by teachers using social media, what they can discuss and how they manage to be involved in the community and develop shared understandings about the challenges of their jobs without risking their professional standing.

The affordances allow the building of social capital and access to information for those who are isolated within their current school. For Rachel, the technological affordances allow her to build social capital in the digital space, providing access to more information. This overcomes the lack of shared goals and understanding in that exists in her current school and eventually allowed her to move to a new

school. Rachel's experience is perhaps not that unusual in the English education system. It is clear that she values the use of Twitter to connect, underlining the importance of social capital for teachers engaging in the practice. While teachers are using Twitter, there is a gap in the literature that looks at the context in which they are physically located and their use of Twitter; Further research should focus upon individuals like Rachel, who are isolated or in toxic schools and how Twitter may provide opportunities for building social capital as well as support networks to overcome these issues. The current literature base is focused upon the learning of teachers and students rather than the emotional and psychological value of the use of Twitter by teachers.

There several broader findings of this study, that are also suitable for further research. These are:

1. The use of Twitter is often driven by the information needs of the teachers involved so they can improve their professional capital and performance of their practice. This was seen in all four participants but could be explored with a larger sample size.
2. There is a lack of discussion around the profile in current research. The profile is not fixed but fluid and is an important aspect of both building social capital in the digital space, as well as for information literacy practices for those involved. For those creating a profile, it allows them to:
  - signal affiliations and interests,
  - indicate a shared practice
  - restrict or enable identification depended on the details provided.

For those looking at other profiles it provides opportunities to:

- identify shared affiliations, interests, and practices
- assess if the user has information that could be of value

- assess if they can get access to this information
  - assess the credibility and trustworthiness of the user and the information they may provide.
3. There needs to be an addition to the social capital model provided by Nahapiet and Ghoshal. Identification in the relational aspect needs to be linked to the access to parties for exchange and combination when used in this kind of digital space. The profile is essential in the construction of the network for all users and is used to make judgements about the user who created it, their legitimacy in the practice and the information they may possess.
  4. Hidden within a dense network of weak ties, there appears to be a sparse network of strong ties with high levels of social bonding. This is not always visible to those using social network analysis methodologies for analysis.
  5. Social capital built online is transferred into face to face social capital and from professional relationships to personal relationships. The relationships are then maintained over multiple digital channels of communication. The social capital built initial as weak or bridging capital then moves to strong bonding capital over time. There is a more complex relationship between face to face, online, personal, professional relationships, than is shown in current research and this would benefit from further research with a focus on how they are maintained over multiple digital methods eg Facebook and Twitter.
  6. There are many affordances in Twitter that these teachers use when they undertake a range of activities as they enact their information literacy practices including:
    - The use of images in a range of ways similar to that found by Yoon and Chung (2016).

- The use of hashtags for searching and providing searchable materials as well as to create shared narratives and bonding capital.
  - The use of hashtags both as a backchannel method at conferences similar to Greenhow et al (2019), but also as a method to store and re find relevant tweets after the event and to save time.
  - The use of both likes and then bookmark affordances in order to store tweets to be able to find them later.
  - The use of tweets allows dialogue to create shared understandings of information over geographical and temporal barriers.
  - The use of other digital affordances outside the platform to create, extract and share information including the use of cloud storage and links, email and email lists, other applications, camera, screen shot and cropping tool. These are often to overcome the constraints of the platform such as character limits and file sizes.
  - Many of these other affordances create additional conduits for information sharing rather than Twitter being the only one or individuals switching to another single one. The participants use multiple digital affordances to maintain their information landscapes over time.
7. The enactment of information literacy practice by the participants is an iterative process of:
- Access → identification → storage → retrieval → meaning making →  
entwining → performance → reflection → sharing.
8. The affordances of Twitter are also used to manage risk by participants for example, the option to have an open or closed account enables users to restrict access to information. Also reported was the use of direct messaging to warn against getting involved in conflicts and the use of blocking and muting to remove individuals and information from their timelines. This was only seen in the three UK participants, and not in the USA. Further research into the conflict

and harassment experienced by teachers on Twitter is important along with the views of underrepresented groups who are more likely to experience cyber-violence.

9. The transfer of information from one context into another is not always possible. Constraints of the platform and the affordances and the ability of the teachers to entwine the information meant it could not easily be extracted or understood. Even if these can be overcome and the information extracted, the site of the teaching practice performance constrained the implementation of the new practice. Researching how teachers extract and change the practices they use from Twitter would be a fruitful avenue of research.
10. The main modalities of information engaged with in this digital space is epistemic and social. There is much use of shared narratives and stories and textual artefacts including worksheets. Information in the corporeal modality was not seen.
11. The access to more information, with the ability to build and sustain relationships enables the development of shared understandings about the knowledge and information that is valued by the community of practice. The engagement with this information allows them to develop their human and decisional capital in conjunction with their performance of teaching in the classroom. This allows them to increase their professional capital. Teachers are better able to perform the sayings and doings of teaching.

The term information literacy is not found in any of the empirical research into Twitter and its use by teachers; therefore this study is a starting point for subsequent research into the information literacy practices of teaching, both using digital affordances as well as non-digital affordances. Expert Teachers are masters

of entwining the corporeal information modality with their social and epistemic information, to spot chewing gum, identify the mobile phone under the table, and know where to stand in the classroom. There is an opportunity in further research to really unpick the information literacy practices of teachers and how they learn to 'become' teachers.

## 6.2 Contribution to Knowledge

This research seeks to fill the gaps in our knowledge about the affordances of Twitter and how individuals enact information literacy via those affordances for professional development. By combining both Twitter timeline data collection and analysis with periodic interviews, I gain an insight into the reasoning behind both the construction of the timeline, their choice of individuals whose content creates that timeline and how Twitter has facilitated the building of social capital within the network to expand their existing information landscape.

This methodology also allows me to explore how the teachers use the affordances of Twitter to help identify information, store it, and then extract it from the timeline in order to integrate it into their knowledge and practice; the practice of information literacy in this context. The use of affordances that bridge across platforms, such as cloud storage, is also explored as a way that individuals enact information literacy using artefacts, carry out discussions around them and create new knowledge. An aspect not considered in the research questions that became apparent on analysis is how individuals used the affordances to manage the risks involved in engaging in this information landscape.

The final aspect of this research is understanding the impact of the use of Twitter on the development of professional capital. Teachers create, access, and disseminate and use information in their setting that they have gained to develop their human and decisional capital. For teachers who have little social capital within

their own existing community, Twitter provides a way of increasing social capital, at little cost, to improve their own professional practice.

### 6.3 Implications of the Study

Evans (2019) states that:

*‘if the professional learning and development field is to advance meaningfully, we need to re-order that agenda, placing informal and implicit processes in a much higher position’. (page 14)*

This research adds to the knowledge underpinning this field by highlighting the importance of understanding the use digital affordances such as Twitter and the information literacy practices involved in building professional networks.

Teachers describe Twitter as the best CPD (Rosell-Aguilar 2018) but this study explains how the affordances enable users to enact information literacy to develop their professional capital.

Lloyd (2017) makes it clear that information literacy is shaped by the context, ‘how people enter and engage with the information landscape and learning information environments, developing ways of knowing about the information and information sources that are important and how to access and use them in ways that are accepted and sanctioned by others in the setting’ (page 100). This research has analysed a specific context, with a community of teachers who engage in information literacy practices using digital affordances of the platform. Through this I have identified how individuals use different affordances to enact information literacy activities such as accessing, storing, retrieval and sharing. When the limitations of those digital affordances constrain their information literacy practice, they will select another from their digital space to meet their information needs.



Schools whose staff are building social capital using the affordances of Twitter, may in fact, be unaware of the benefits that this brings to them as they are unaware of the informal nature of the learning that is being undertaken. By putting the role of social capital as part of professional capital, front and centre we could improve the practice of the profession overcoming organisational, geographic, and temporal barriers to facilitate the movement of information across boundaries. The role of social capital in the development of practice is perhaps currently underestimated, or not acknowledged within schools, and yet, it could be a powerful tool for improvement of practice.

While many schools are harnessing this digital affordance, the restrictive nature of some 'online policies' produced by schools puts many in fear for their career. Instead of discouraging teachers from use of social media, it would be better if schools worked to produce guidelines in its use in professional contexts. Highlighting the benefits, but also how to ensure they are not in a position where they can be considered unprofessional.

Schools who have staff on Twitter should be encouraged to bring the learning and information they have found, back into the school community and shared with those that are not on the platform. This requires not only schools to recognise that Twitter is a valuable source of information but create the time and opportunities for dialogue and discussion around the information. Perhaps, this is the greatest challenge in such a demanding profession.

The research has raised several further questions; the role of social capital built on Twitter for those who are isolated from information landscapes in their own setting such as Rachel experiences would be avenue for further research. Also, the information literacy activities and experiences of those from minority groups as these are currently underrepresented in research, particularly in light of the conflict experienced by Dev and Rachel.

Having identified the digital affordances and uses, the limitations involved in the sample in this study could then overcome by using it as a basis for studies using larger sample of individuals to identify the patterns in information literacy practices both within teachers use of Twitter, but also other professional practices. Further research could draw on bigger samples of participants using aspects such as self reporting, questionnaires or research diaries to collect ongoing data as well as semi structured interviews. Focus groups would also be a fruitful avenue of research, particularly as technology such as Microsoft Teams or Zoom can facilitate this across geographical boundaries, allowing more participants to be involved.

Evans (2019) states that we need to move away from methods that rely on 'research participants' episodic memory recall'. The approach of repeated interviews on in time with the stimulated recall use of the Tweets has reduced the demands on the participants to recall specific episodic events and allowed them to construct narratives on their learning as it happens. As Schatzki states, practice is 'a nexus of doings and sayings that are spatially dispersed and temporally unfolding' (Schatzki 1996 page 89). The longitudinal observation and data collection allowed me to discovered aspects of how teachers enact their information literacy practices on Twitter over time that I would not have found with a 'snapshot'.

## **6.4 Impact on my Professional Practice and Myself as a Researcher**

I initially started with a simple question – 'how do teachers learn from each other?' and have benefited from being able to explore this through literature, research practice, discussion and ultimately construction of this thesis. My ability to engage critically with research, to develop both my methodological practice as well as academic writing has been significant. As there is an increasing emphasis on research in education, I have a much more critical eye on the claims made and the

ability to transfer research into practice. I am able to read and synthesise research from across the education field with a critical view while understanding the difficulties that can be faced in transferring it into practice. My own information literacy practice has expanded to include the ability to access and entwine much of the academic and research literature I have used and opened up my understanding of my own information landscape, particularly the social and corporeal modalities of information I receive and act on each day.

This development as a researcher was brought home to me in a Twitter exchange to challenge an individual who is highly regarded in teaching. Using my critical thinking and reasoning skills, combined with my knowledge of biology, psychology, and physics I constructed a carefully reasoned and informed argument. This was something I would never have been able to do prior to this research as I lacked the academic reasoning skills and the confidence to challenge others. This is no longer the case.

In the time taken to complete this research project, I have moved through several communities of practice before joining and leading my current one. Throughout this, Twitter's community of teachers has held an important place in my information landscape. This role as researcher, member of the network on Twitter and visitor to other communities of practice has enabled me to observe professional capital in action across face-to-face and online communities. My role as a researcher has placed me in a stronger position as I begin to develop my role coaching other colleagues, as I understand the importance of social capital and its role supporting others to access different modalities of information. This has deepened my commitment to developing not only my own practice, but the practice of others in my profession. As a leader of others, I am also much more intently aware of the informal and implicit learning that my staff undertake in their daily working life and the sources of information they are able to access.

My thesis has not only allowed me to access and make meaning of research across the field but understand the complex nature of information literacy practices. As an individual I now feel I understand how I have become a practitioner who others look to when needing help to develop their own practice.

## 6.5 Conclusion

By combining together literature on social capital and information literacy practices with the digital affordances of Twitter, this research has developed our understanding of how some teachers enact their information literacy and possible why teachers value Twitter as a site of this practice. This provides further empirical evidence for the information literacy field as well as the field of social media in education. While Evans (2019) acknowledges that implicit and informal learning is difficult to research, the use of social media and its affordances allow the development of different research methods in order to illuminate the processes involved in this type of professional learning and the information literacy practices surrounding it.

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## Appendix A: Twitter Terminology

from <https://help.twitter.com/en/glossary>

### @

The @ sign is used to call out usernames in Tweets: "Hello @twitter!" People will use your @username to mention you in Tweets, send you a message or link to your profile.

### Block

If you block a Twitter account, that account will be unable to follow you or add you to their Twitter lists, and you will not receive a notification if they mention you in a Tweet.

### Direct messages

(DM) Direct Messages are private messages sent from one Twitter account to another account(s). You can use Direct Messages for one-on-one private conversations, or between groups.

### Follow

Subscribing to a Twitter account is called "following." To start following, click or tap the Follow icon next to the account name on their profile to see their Tweets as soon as they post something new. Anyone on Twitter can follow or unfollow anyone else at any time, with the exception of blocked accounts.

A follow is the result of someone following your Twitter account. You can see how many follows (or followers) you have from your Twitter profile.

### Following

A follower is another Twitter account that has followed you to receive your Tweets in their Home timeline.

## Hashtag #

A hashtag is any word or phrase immediately preceded by the # symbol. When you click or tap on a hashtag, you'll see other Tweets containing the same keyword or topic.

## Like

Liking a Tweet indicates that you appreciate it. You can find all of your likes by clicking or tapping the Likes tab on your profile.

## Mention

Mentioning other accounts in your Tweet by including the @ sign followed directly by their username is called a "mention". Also refers to Tweets in which your @username was included.

## Mute

You can mute accounts; [mute words, phrases, usernames and hashtags from your notifications](#); and [mute Direct Message notifications](#).

## Night mode

Night mode for Twitter features a dark-colored palette that is optimized for experiencing Twitter comfortably in low-light situations. The night mode feature is available on [twitter.com](https://twitter.com), [Twitter for iOS](#), and [Twitter for Android](#).

## Pinned tweets

You can pin one of your Tweets to the top of your profile page to keep it above the flow of time-ordered Tweets

## Profile

Your profile displays information you choose to share publicly, as well as all of the Tweets you've posted. Your profile along with your @username identify you on Twitter.

## Profile photo



The personal image (avatar) associated with your account. It's also the picture that appears next to each of your Tweets

### Protected tweets

Tweets are public by default. Choosing to [protect your Tweets](#) means that your Tweets will only be seen by your followers.

### Reply

A response to another person's Tweet. Reply by clicking or tapping the reply icon next to the Tweet you'd like to respond to. A direct reply count is displayed next to the reply icon of a Tweet, and indicates the total number of replies the Tweet has received.

### Retweet

A Tweet that you forward to your followers is known as a Retweet. Often used to pass along news or other valuable discoveries on Twitter, Retweets always retain original attribution.

### Retweet (verb)

The act of sharing another account's Tweet to all of your followers by clicking or tapping on the Retweet button.

### Timeline

A timeline is a real-time stream of Tweets. Your Home timeline, for instance, is where you see all the Tweets shared by your friends and other people you follow.

### Thread

A series of connected Tweets from one person. You can provide additional context, an update, or an extended point by connecting multiple Tweets together

### Tweet (noun)

A Tweet (up to 280 characters) may contain photos, GIFs, videos, and text

#### Tweet (verb)

The act of sending a Tweet. Tweets get shown in Twitter timelines or are embedded in websites and blogs.

#### Tweetdeck

Available on [tweetdeck.com](https://tweetdeck.com) or Mac app store, Tweetdeck offers a more convenient Twitter experience with managing multiple Twitter accounts, scheduling Tweets for posting in the future, building Tweet collections, and more.

#### Username

A username (or handle) is how you're identified on Twitter, and is always preceded immediately by the @ symbol. For instance, Twitter Support is @TwitterSupport.

## Appendix B: Participant Recruitment Tweet



## Appendix C: Participant Information Sheets

University of Manchester  
School of Environment and Development

Moving knowledge around – Teachers using Twitter

### Participant information sheet

Thank you for your interest in my research project:

My research will seek to answer six questions:

1. Why do science teachers use social media networks that focus on professional practice?
2. What, if any, knowledge and techniques are teacher participants in a virtual teacher network sharing with each other over time?
3. What are the factors that shape the teacher participant's decision to share their knowledge and techniques and does this change over time?
4. What, if any, knowledge and techniques are teacher participants in a virtual teacher network taking from the network over time? (*what techniques or information are they taking from Twitter over the period of the research*)
5. What criteria do teacher participants use to decide what knowledge to use and from whom in their virtual network, and does this change over time?
6. What impact on their professional practice do teacher participants feel from using these knowledge and techniques?

In order to do this, I need participants who

1. Are willing to let me follow their interactions and posted Tweets on Twitter for the course of the 6-9 months of the project. You need to have a public Twitter account and be actively involved in sharing and collecting ideas from Twitter if possible.
2. Are willing to be interviewed via Skype several times over the course of the research and that those interviews will be recorded. Some interviews will be longer (30-45 mins) while some will be shorter (10-15 mins). The number of interviews will be structured according to the Twitter data. For example, if you Tweet something of interest and have a conversation with others, I would like to interview you shortly after this in order to gain your immediate understanding and decisions rather than waiting.
3. Willing to be interviewed about their use of Twitter, how it has shaped their

professional practice and how they have made decisions about their use of Twitter and their practice.

All participants will remain anonymous and have the right to withdraw at any time.

All tweets will be as anonymised as possible so the chance of them being linked back to you is minimised.

## Appendix D: Participant Consent Sheet

University of Manchester  
School of Environment and Development

Moving knowledge around – Teachers using Twitter

### CONSENT FORM

If you are happy to participate please read the consent form and initial it:

1. I confirm that I have read the attached information sheet on the above project and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to any treatment/service

Please Initial

3. I understand that the interviews will be audio/video-recorded
4. I agree to the use of anonymous quotes
5. I understand that my comments on Twitter will be tracked and stored for the duration of the project.

I agree to take part in the above project

Name of participant  
Signature

Date

Name of person taking consent: Lucie Golton

Date: 14/03/18

Signature

## Appendix E: Interview 1 Topic Guide

### INTERVIEW GUIDE:

#### INITIAL INTERVIEWS

Tell me about your current school

Tell me about your current role

Describe your school.

How many people in your department?

Who do you talk to about teaching on a regular basis?

If you have an issue at work, who would you go to first?

Why did you join twitter?

What ideas have you taken and implemented from Twitter?

Do you adapt or change what you use on twitter? How?

How do you decide what to take from Twitter?

Why did you join Twitter?

Is there anything you have rejected from Twitter?

Who do you go to first or trust the most?

Who or what have you rejected from the network?

What have you shared with the twitter network?

What do you see the role of the teacher?se

Who do you think is the most influential person you are following? Why?

Who do you disagree with?

Talk me through your feed –

Why did you post this particular tweet?

What were you looking for when asking about this?

Who responded? Did it end up with a conversation?

What did you take from it and use in the classroom?

What do you know now that perhaps you didn't know before?



## Appendix F: Subsequent Interviews Topic Guide

### Subsequent interview

What has happened since the last time we talked?

Have you tried anything new?

Have you been to any events or similar

Talk me through your feed –

Why did you post this particular tweet?

What were you looking for when asking about this?

Who responded? Did it end up with a conversation?

What did you take from it and use in the classroom?

What do you know now that perhaps you didn't know before?

# Appendix G: Sample Data from TweetDeck

The image shows a screenshot of the TweetDeck application interface. On the left is a dark sidebar with navigation options: 'Add column', 'Collapse', 'Accounts', 'Settings', and a user profile for 'oocie @Yorks\_Bunny'. The main area is divided into four columns, each displaying a thread of tweets. Column 11 shows a tweet from 13 Apr 2018 about joining a group, followed by a video of a torsion pendulum lab. Column 12 shows a tweet from 16 Jul 2018 about exam marking, a tweet from 10 Jul 2018 about dice cricket, and a tweet from Jun 2018 about missing an iPad. Column 13 shows a tweet from May 2018 about financial situations and a tweet from 2 Jun 2018 about a conference with a '#BrewEd Wigan' mug image.

## Appendix H: Blog Post - Beth

# THE BLOG OF PHYZ

High school physics education issues as seen by some California teachers: From content standards to critical thinking

Monday, March 26, 2018

## #GraphFail

You know it's a bad situation when the hashtag basically writes itself.

This first year of teaching AP Physics C: Mechanics and Electricity & Magnetism has had lots of lessons, one of which I was not expecting. I assumed (and you know the old saying about *assuming* anything) that students in AP Calculus or Multi-Variable Calculus could graph data. And I was wrong.

Well to clarify, they *can* graph but they often choose not to. Be it innate teenage laziness, prioritizing their overwhelming workload, or even just forgetfulness, my students don't spend the time on their lab graphs that I would expect. My expectations were laid out at the beginning of the year, as they were in regular Physics and I'm sure every science class they have ever taken. They are summarized below:

PHYS/ED/SKEPTIC BLOGS/CHANNELS

[Veritasium](#)  
2 days ago

[The Skeptics' Guide to the Universe](#)  
6 days ago

[Physics Girl](#)  
1 week ago

1. All plotted graphs (not sketches) should be at least a half a page in size and made on graph paper.
2. Axis and best fit lines should be made with a ruler.
3. Each axis should be labeled with the quantity and units. Each axis should have a uniform scale but it need not be the same from one axis to the other.
4. The graph should have a descriptive title (i.e. not "Graph #3").
5. If multiple data sets are plotted use different colors and/or different data point symbols. Include a legend.
6. Add a best fit line or curve to your data that gets as close as possible to all of your data points. Do **not** "connect the dots." If the best fit relationship is linear include a slope triangle to calculate the slope of the line.

I don't feel that any of these requirements are too extreme, strict or beyond what they are being taught in math class. Yet as the year has progressed I have seen the graph quality decrease. The occasional student "forgets" to do it on graph paper; I may let it slide. Once in awhile someone makes the graph too small and I'll draw an unhappy face on it in red pen. The mistakes were becoming more common but due to drowning in curriculum development I kept ignoring the growing problem.

But then it became too big. Last week I collected student lab notebooks with two labs in it. One required several graph sketches (just a variable labeled axis and a general shape, no plotting) with two plotted graphs and the other only required two plotted graphs. Students had *begged* for additional time for lab notebooks and after agreeing I joked that I was expecting perfection.

I did not get it.

It started with one unbelievable graph. Bad enough that I snapped a picture and posted it on my Twitter feed. Then there was another. And another. I collected enough of the "worst" that I decided that I had to have a little "talk" with my classes about quality of work. I assembled them into a powerpoint and planned the reckoning.

The big day was today and I had it all set up to make the big points in an amusing way, but letting them know I was serious. I started each class with, "I graded your lab notebooks. We need to have a bit of a chat. What math level are you in again?"

Students warily reply "Calculus..." because they know they're getting set up.

"Oh that's right," I reply, "So you should be able to make a graph right?"

They nod.

"Well, I thought so too, but we need to talk about that."

In one class a student said, "Oh man, she made it into a powerpoint, that *can't* be good."

I assured students that these contributions were anonymous, and that if their graph was included I still care for them and I know that they can do well in Physics. They just had a big "oops" with this graph.

We proceeded to flip through the examples, with a mixture of roaring laughter (to the point of tears for some) and absolute disbelief.

They had questions:

"Someone turned *that* in?"

"Is that a *hole* in that paper?"

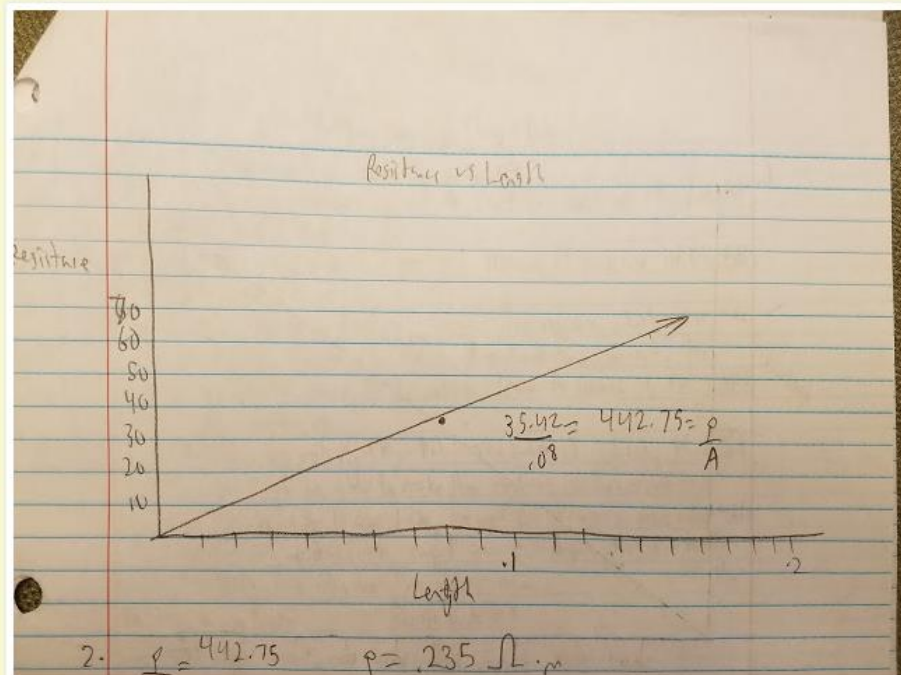
"What is that line even supposed to be doing?"

"Were these all from that *one* assignment?"

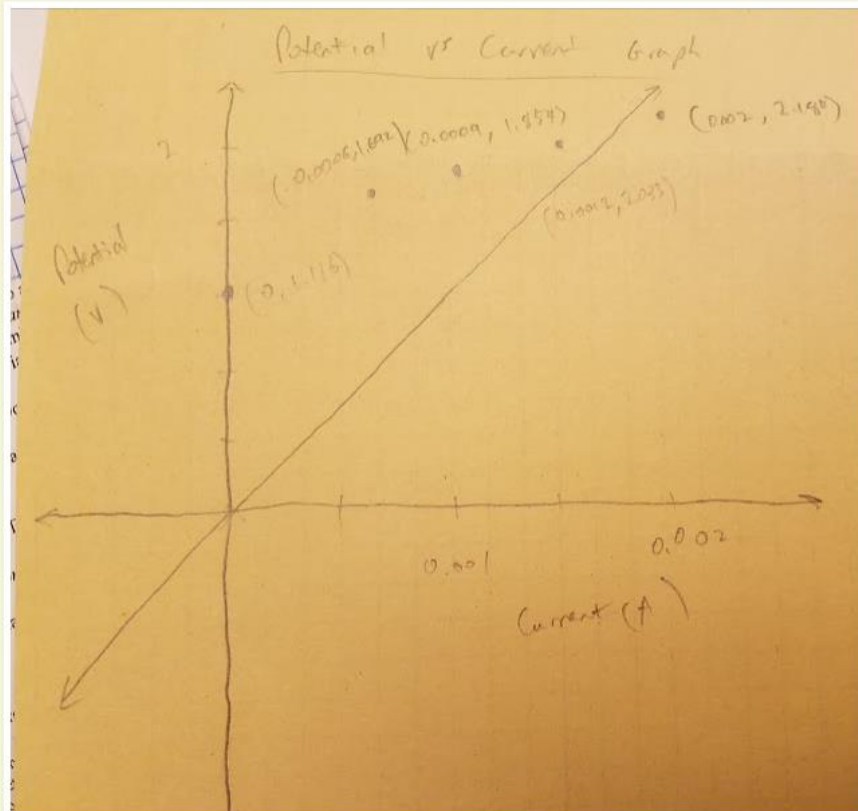
One student at the end said, "Wow, and we had extra time so you wanted them to be perfect."

Yeah kid, I was shocked too.

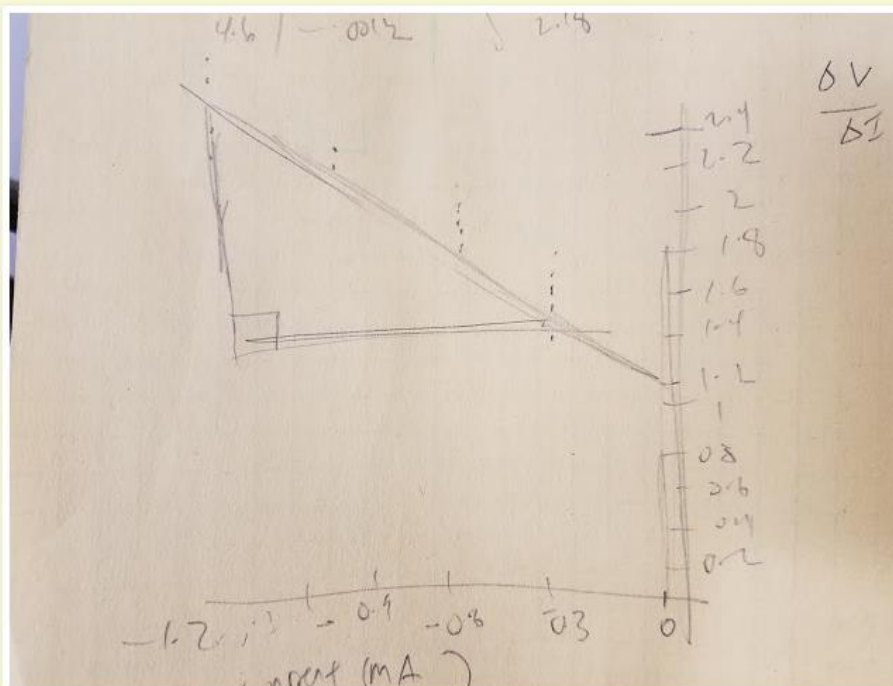
In the end it was a funny way of reminding them of my expectation, and now I have a collection of some of the worst graphs I've ever seen. Of course I would rather not have had the situation at all but at least we can all benefit. The collection is available as a [pdf](#) and individually below. Feel free to use in your classroom for the same purpose, hopefully they help you avoid your own #GraphFails.



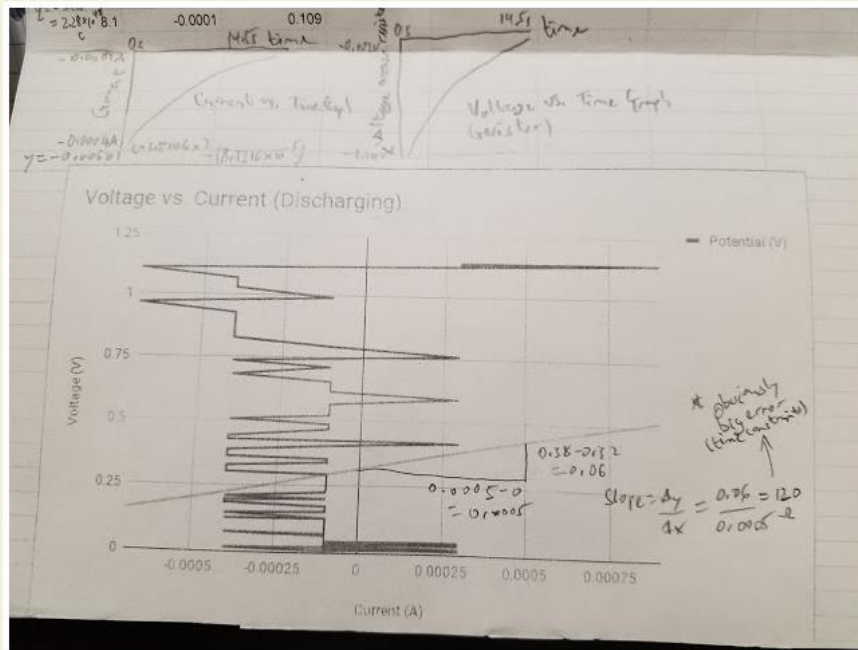
Only one data point really? No ruler used for the axis, not made on graph paper, no slope triangle and the best fit line doesn't even go through the single data point!



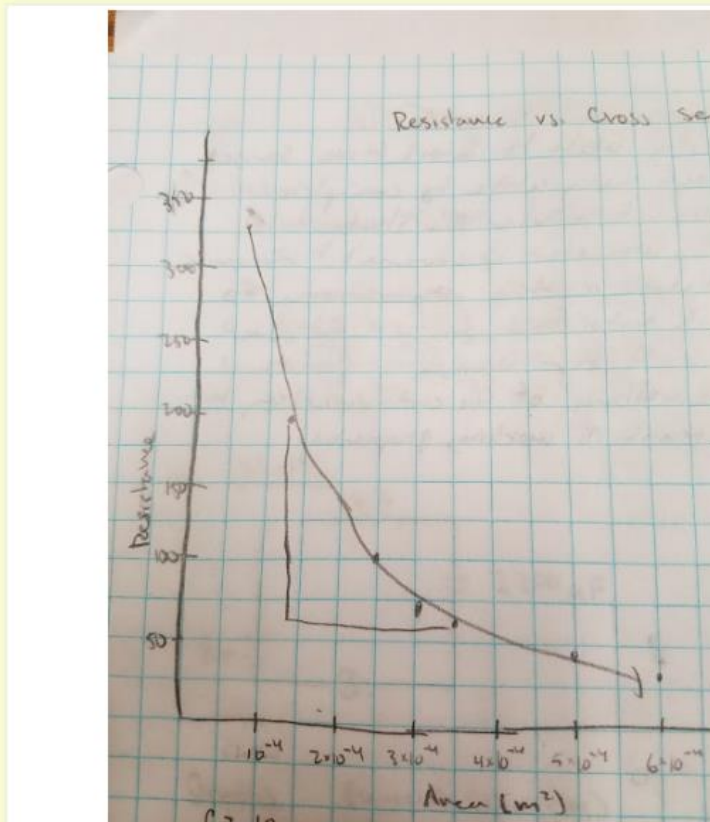
One of my students said that this apparent best fit line (that completely missed every data point) might be a Z-axis. I don't know if that makes it better. And no, seeing the grid through the back side of a blank piece of graph paper doesn't count.



Not on graph paper, not made using a ruler and made a thicker line (potentially to hide poor data). Actually I don't even know if these data points are even properly plotted. We decided this was more of an artistic representation of someone else's graph than a graph itself.

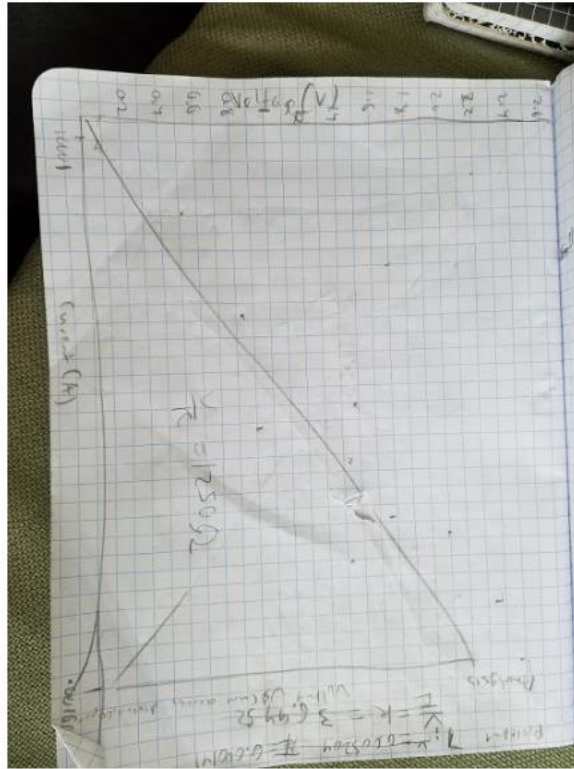


Students often ask to use Excel, and they can, as long as they can use it right. This is not right. I have no idea how that best fit line worked with that data.

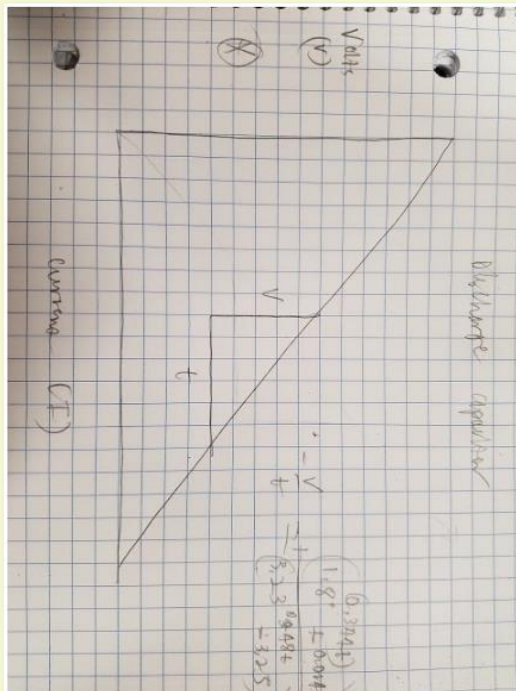


If you're asked to make a slope triangle on your graph it will probably be linear. When in doubt, the student apparently thought drawing a slope triangle would help anyway.

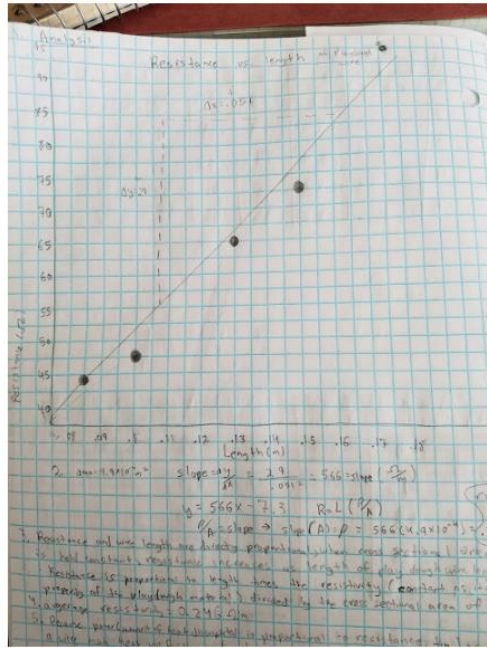




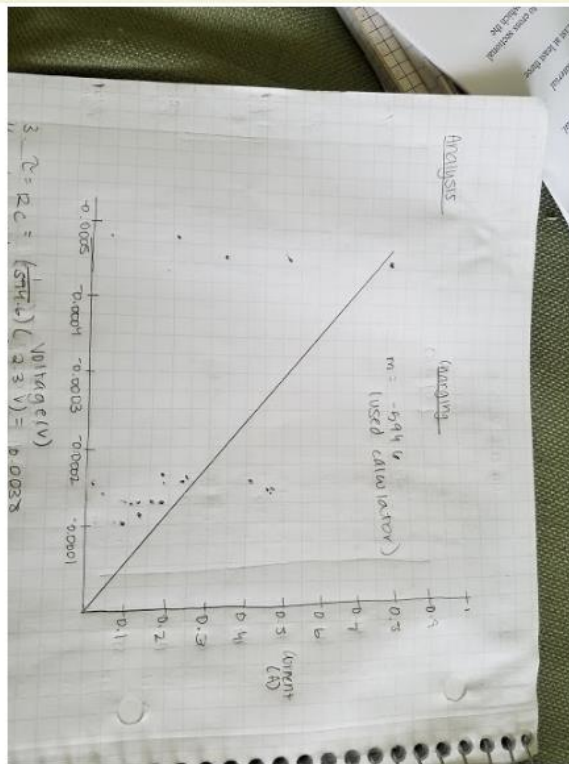
When I said a "uniform scale on each axis" I didn't think I need to be specific and say you need more than one number to establish a scale.



Of course having no scale is worse.

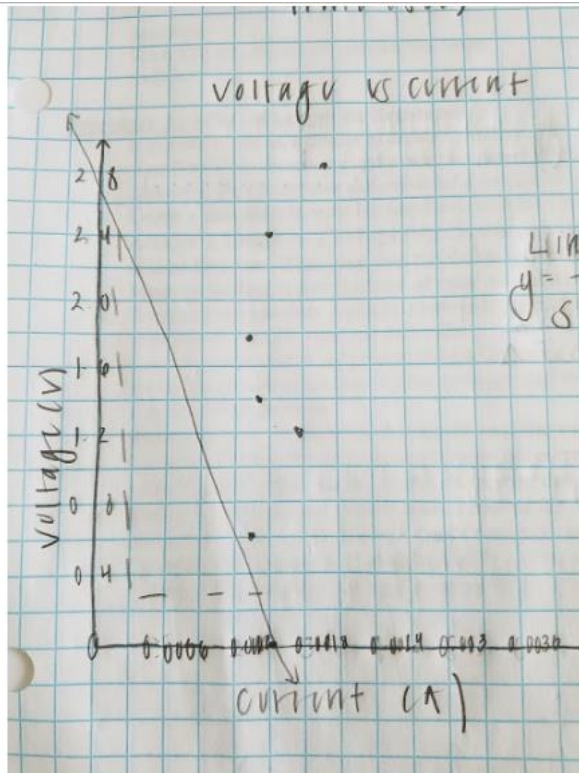


The large data points on this were annoying but not terrible. It was the sneaky breaking of the graph that they tried to slip past me.

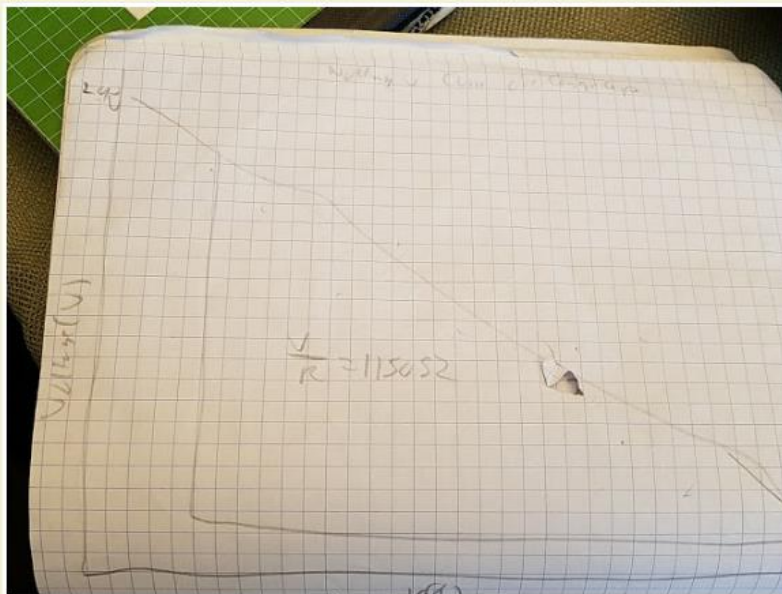


When your data doesn't seem to have a trend, I guess plugging it into a calculator is one way of finding a be





Then again, even if the best fit line seems obvious maybe you should use your calculator to double check.



Sigh.